

Patterns and Factors Associated with Environmental Health Practices in Households of Rural Mozambique

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By

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“A method which is freely available and of small benefit may be more useful than one which is more effective but unavailable” (Lines et al., 1989)

Abstract

Analytical quantitative studies focusing on health-related behaviours as the final outcomes are scarce, especially in the field of Environmental Health. They have mostly focused on behaviours as risk factors for disease and have rarely dealt with determinants of such behaviours.

This study examines the relationship between socio-economic, psychosocial, demographic, and environmental factors and Environmental Health practices at the household level. It further explores, qualitatively, lay perceptions of such practices and illnesses associated with them.

An analytical cross-sectional study, complemented by a qualitative study, was the approach chosen for this purpose. Fieldwork took place in Manhica, a rural district in Southern Mozambique, from October 2002 to November 2003. The cross-sectional study comprised the following data collection methods: a socio-economic and demographic questionnaire, spot-check observations, and a questionnaire on women's autonomy covering 405 households, and structured observations covering 102 households. The qualitative study comprised 12 focus group discussions (involving 134 people in total) namely with mothers, grandmothers and fathers of children under 5, and 25 semi-structured interviews with caretakers of children under 5.

Using factor analysis, three dimensions of wealth (characterising households) and five autonomy constructs (characterising caretakers of children under-5) served as the main predicting factors that the study sought to explore in relation to Household Environmental Health (HHEH) practices. Other predicting factors of interest were type and domain of water source, child's age, and caretaker's age.

Prevalence of latrine ownership was high (95%), and so was soap availability (86%). Sixty-two percent of households had access to water from

taps (either private or public). However, hand-washing with soap was observed on 6% of occasions after potential faecal contact, and children's stools were disposed of in the latrine on 6% of occasions after open defecation events.

In terms of access to hygiene and sanitation hardware, only caretaker's education predicted latrine ownership, and access to soap was associated with caretaker's education, caretaker's exposure to information and socio-economic status of the head of household.

With regards to hygiene and sanitation practices, there was no strong evidence for the influence of any of the predicted factors on hand-washing. Socio-economic status of the head of household and type of water source were the only variables significantly associated with safe disposal of stools. Infants under 1 and children between 2 and 5 years of age were the most likely to contaminate the household environment with faeces.

Regarding mosquito deterrence practices, it was found that the likelihood that children under 5 were protected by any deterrence method increased with increased caretaker's education and with caretakers decreased proximity to maiden family. Use of traditional fumigation in the child's bedroom was associated with decreased accumulation of modern assets, increased accumulation of traditional assets, and increased caretaker's age. Protecting children under 5 with commercially available products other than bednets was associated with caretaker's education and her financial independence. Bednet use by children was predicted by increased head of household socio-economic status, accumulation of modern assets, and decreased proximity of caretaker to her maiden family.

It was also found that certain hygiene and sanitation practices are highly clustered and that there are greater psychosocial connotations carried by sanitation practices than by mosquito deterrence practices.

The qualitative study revealed that, from the study participants' perspective, HHEH practices, in particular latrine possession status were associated with the following factors: authority, social commitment, value for self, self-reliance, self-organisation, and completeness. Good fortune was

particularly related to bednet possession. Lack of initiative and modernism were personal attributes viewed to be associated with both not having bednets and not having latrines.

Through its detailed examination of the associations between individual and household characteristics and behaviour outcomes this study makes an original contribution to our understanding of how risk and protective practices are produced at household level. This is of interest to those who seek to understand human behaviour from an academic perspective and to those who seek to influence it in order to improve health outcomes. For example, the study adds a contribution to HHEH behaviour change initiatives, especially those that require criteria in order to carry out selective targeting of households according to their social, economic, demographic, or environmental characteristics.

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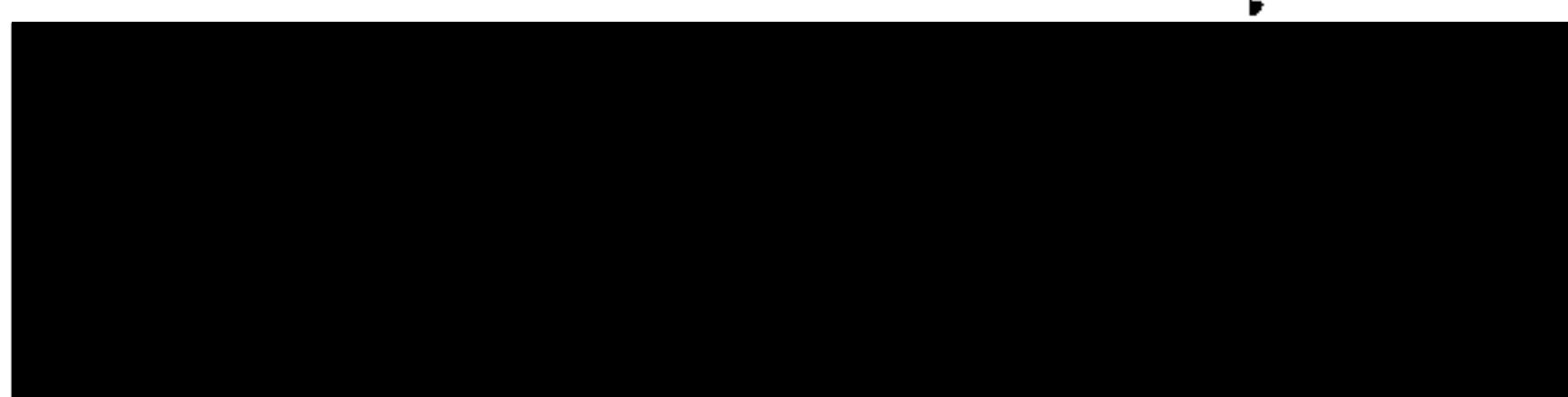
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I dedicate this thesis to my brother Edgar Munguambe: Que esta sirva de inspiração para quaisquer que sejam os objectivos que desejares alcançar.

Statement

I declare that this thesis is my own work and conception. It was conducted under the supervision of Adam Biran at the London School of Hygiene and Tropical Medicine (LSHTM), and an advisory panel comprising staff from the LSHTM and UCL.

The research was conducted in collaboration with the Centro de Investigação em Saúde da Manhica (CISM). The fieldwork was conducted by me, with the assistance of fieldworkers, whom I directly supervised. I performed all data entry and analysis.

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Khátia Rebeca Munguambe

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Abbreviations

Abbreviation	Full term
AIDS	Acquired immunodeficiency syndrome
ARI	Acute respiratory infection
CISM	Centro de Investigação em Saúde de Manhiça
Ct, CT	Caretaker
DDT	Dichlorodiphenyltrichloroethane
DHS	Demographic and Health Survey
DSA	Demographic Surveillance Area
DSS	Demographic Surveillance System
EA	Enumeration area
EH	Environmental Health
FGD	Focus group discussion
GDP	Gross domestic product
HHEH	Household environmental health
HH	Household
HIV	Human immunodeficiency virus
HoH	Head of household
Hw	Hand-washing
Hwvs	Hand-washing with soap
IAP	Indoor air pollution
IMF	International Monetary Fund
INDEPTH	International Network of Demographic Evaluation of Populations and Their Health
INE	Instituto Nacional de Estatística (National Institute of Statistics)
IPT	Intermittent preventive treatment
IRS	Indoor residual spraying
ITN	Insecticide-treated net

Abbreviation	Full term
ITM	Insecticide-treated materials
KAP	Knowledge, attitudes and practices
MoH	Ministry of Health
MRH	Manhiça Rural Hospital
N, n	Sample size
OR	Odds Ratio
ORS	Oral rehydration solution
ORT	Oral rehydration therapy
PAF	Principal axis factoring
PCA	Principal components analysis
PHAST	Participatory Hygiene and Sanitation Transformation
PHC	Primary Health Care
PI	Principal investigator
RCT	Randomised controlled trial
SES	Socio-economic status
SSA	Sub-Saharan Africa
UN	United Nations
UNDP	United Nations Development Programme
UTN	Untreated net
WFS	World Fertility Survey
WHO	World Health Organisation

Chapter 1 **Introductory chapter**

Chapter summary

This chapter is organised in 2 sections. The first introduces the concepts of Environmental Health and Household Environmental Health, and culminates with a brief account of the organization of this thesis. The chapter finalises with the study aims and objectives.

1.1 Introduction to the concept of HHEH

Despite the fact that the present epoch has witnessed great improvements in child survival, mortality rates in children under-5 still constitute a major global problem. In the year 2000 it was estimated that nearly 11 million children had died before reaching their 5th birthday, mostly due to preventable health problems. Seventy-five percent of those deaths occurred in Sub-Saharan Africa and South Asia (Black *et al.*, 2003).

Table 1-1: Leading causes of death in children in developing countries (2000-2003)

Rank	Cause	Numbers (000)	% of all deaths
1	Perinatal conditions	3 910	37
2	ARI	2 027	19
3	Diarrhoeal diseases	1 762	17
4	Malaria	853	8
5	Measles	395	4
6	HIV/AIDS	321	3
7	Injuries	305	3
	Other causes	1 022	10
	Total	10 263	100

Source: WHO, 2005

According to recent global estimates (Table 1-1), malaria and diarrhoea together account for 2.6 million (25%) of under-5 deaths in developing countries (WHO, 2005). These 2 diseases have in common that environmental conditions surrounding the child, in particular at household level, can play an important role in promoting or interrupting transmission. This brings to discussion the concept of Environmental Health (EH).

“The links between environment and health are intuitive to all of us” (Cairncross & Kolsky, 2001)

Over 20 definitions of EH have been found in the literature. While some definitions treat Environmental Health as a discipline, others look at it as an approach, and yet others as a mere state of affairs concerning individuals and their communities. Despite there yet not being agreement in the definition of the concept, in characterizing EH, most scholars converge in the view that it encloses risks to health in the household, workplace and outdoor environments (Cairncross & Kolsky, 2001). Two of the most thorough currently used definitions are given below:

“Environmental Health comprises those aspects of human health, including quality of life, that are determined by interactions with physical, chemical, biological and social factors in the environment. It also refers to the theory and practice of assessing, correcting, controlling and preventing those factors in the environment that may adversely affect the health of present and future generations”. (World Health Organization)

“Environmental Health is the professional practice of improving and preserving residential and industrial hygienic environments and housing for individuals and communities, and improving and preserving public health and allied matters including the control and management of the total environmental and ecological balance by educating processes

and enforcement of statutory provisions by the application of preventive science and practice". (Institute of Environmental Health - Australia)

The above definitions represent two issues. The first is with respect to health risks to humans, associated with exposures to precursors found in the environment. The precursors range widely from physical or chemical agents (e.g., particles of smoke), to biological (e.g., viruses, bacteria, protozoa, helminths). The second issue is regarding behavioural environmental interventions to reduce exposure. Such interventions tend to maximise health gains by creating or reinforcing environmental barriers to the above-mentioned precursors, in contrast with clinical or nutrition interventions.

This study is particularly concerned with the aspect of the definition regarding assessing factors in the environment that may adversely affect the health of present generations. In particular, the study focuses on practices and conditions relating to interactions between men and the environment, which in turn affect children's exposure to particular hazards (e.g., mosquito bites and contact with faecal material) and hence their health in terms of risks to diarrhoeal disease or malaria. By documenting such practices or conditions, the study contributes towards the recognition of important risks expressed in the form of behaviour, which may be shaped by contextual social, economic and cultural factors.

Despite there being inventories of EH risks, which include accidents, unsafe housing, and contamination of air, water or food with physical, chemical or biological agents (Cairncross & Kolsky, 2001; Prüss-Ustün *et al.*, 2003; Satterthwaite *et al.*, 1996; UNEP, 2002), the existing definitions do not clearly set boundaries to the concept. Nonetheless, there have been attempts to classify the different risks considered environmental, mostly for practical reasons. For example, to assist in the rational development of health policies (Prüss-Ustün *et al.*, 2003; UNEP, 2002). These classifications may shed some light into attempts to identifying what is currently considered a component of EH and what is not.

When referring to the environmental burden of disease, WHO considers 2 categories of environmental risk factors: “specific agents” and “media carrying the hazards” (posed by those agents) (Prüss-Ustün *et al.*, 2003). “Media” include water resources, food, agricultural environments, and indoor and outdoor air. Examples of “agents” are chemical substances, noise, and radiation (Prüss-Ustün *et al.*, 2003). The authors recognized some level of ambiguity in this classification by stating that media and individual risk factors may overlap (Prüss-Ustün *et al.*, 2003). Prüss-Ustün and colleagues (2003) added one type of hazards to their classification: behavioural risk factors, but they cannot be separated from the other risk factors. For example, the risk of accidents requires contributions of specific behaviour risk factors, so do risks from vectors, and chemical, microbiological and physical hazards. In the same way behaviours can reduce or impede the risk factors’ impacts on health.

Another way environmental risks have been categorised has been according to the nature of the hazard they represent, namely accidents, vectors, and chemical, microbiological, and physical hazards (Prüss-Ustün *et al.*, 2003).

A classification of environmental risks into 2 broad categories, namely “traditional” and “modern” gave an idea of how broad a scope environmental health can cover (UNEP, 2002). Traditional environmental threats to human health often arise from or are aggravated by lack of development and include biologically contaminated water, poor sanitation, indoor smoke, disease vectors such as mosquitoes, poor hygiene, and unsafe waste disposal (UNEP, 2002). Modern hazards, which result from unsustainable patterns of development, comprise climate change, ozone layer depletion, pollution of air, water, and soil due to unsafe handling of chemicals and inadequate solid and waste management. Again this classification has ambiguities, for example it is not clear what differentiates the mentioned “traditional” waste disposal from “modern” inadequate waste management. Perhaps the authors meant to differentiate between waste management from industry and household-level waste disposal.

The “traditional” environmental risks, often with immediate health impacts (Satterthwaite *et al.*, 1996), were considered the primary factors underling the current health problems in the majority of the world’s population (UNEP, 2002). As can be seen from the examples given above, which illustrate the distinction between traditional and modern hazards, most “traditional” risks can occur at the level of the household. Indeed, it has been calculated that in the less developed regions, 30% of the burden of disease could be averted by improvements in the environment at household level (World Bank, 1993). However, the “modern” environmental risks, or, as put by Satterthwaite and colleagues, the environmental concerns of the wealthier inhabitants (i.e., those living in Europe, North American, and Japan), have been those dominating the discussions on EH issues (Satterthwaite *et al.*, 1996).

As demonstrated with the above examples, characterization of constituents of EH has been a complex endeavour. The fact that the effects of environmental exposures on health depend on interactions with the social settings in which the exposures occur, technology, and individual behaviours (Ezzati *et al.*, 2005; Prüss-Ustün *et al.*, 2003) further complicates it.

Cairncross and Kolsky (2001), who focused on “traditional” EH variables, have identified major components of EH interventions. According to these authors EH interventions are activities or environmental services targeted at households and communities, which endow them with hazard-free natural and built environments (Cairncross & Kolsky, 2001). The following were examples given by the same authors:

- Excreta disposal
- Water supply
- Hygiene
- Air pollution control
- Vector control
- Food safety
- Solid and clinical waste management
- Water drainage

- Wastewater management and use
- Road safety management

Cairncross and colleagues (1996) distinguished the transmission of EH-related infectious diseases within the domestic domain from that within the public domain. These domains have also been referred to as the private and the community domain respectively (EHP, 1999). The domestic domain refers to the areas normally occupied by and under the control of the household (Cairncross *et al.*, 1996). Behaviours within this domain are actions that individuals or families put in place, such as washing hands (EHP, 1999). The public domain comprises areas beyond the control of single households, namely schools, workplaces, trading and recreational areas, streets and fields (Cairncross *et al.*, 1996). Public domain practices are therefore collective actions that call for people to work together, for example the use and maintenance of public water sources (EHP, 1999). From the type of public domain practices above exemplified, it can also be said that public domain practices are likely to entirely depend on services provision, be it public or private (e.g., public provision and maintenance of water supply or public latrines, and refuse collection).

Practices carried out and resources used within the domestic domain were of most interest, therefore the household was the social unit that served as the focal point of data collection and analysis in the present study.

To the author's knowledge, Household Environmental Health (HHEH) has not been defined. Using the body of knowledge above presented with regards to a definition of EH and its components, in the context of the present research, HHEH refers to environmental hazards within the domestic domain and the likely contributions of technology, behaviours and social components to the modification (enhancement or hindering) of the health impact of those hazards. Part of those technological and behavioural components at the HH level, mainly hygiene, have been considered and classified in 5 clusters, as can be seen from Table 1-2 (Boot & Cairncross, 1993).

Table 1-2: Hygiene clusters and their elements in the context of HHEH

<p>Disposal of human faeces</p> <ul style="list-style-type: none"> • Choice of place for defecation • Cleaning and maintenance of toilet • Disposal of children's faeces • Anal cleansing practices • Disposal of faeces, cleansing materials, and children's clothes soiled with faeces • Hand-washing after handling faeces
<p>Use and protection of water</p> <ul style="list-style-type: none"> • Choice of water source • Water collection and transport • Water handling in the home • Water storage and treatment • Wastewater disposal
<p>Personal hygiene</p> <ul style="list-style-type: none"> • Washing of hands, body and face • Hygiene after defecation • Washing and use of clothes • Choice of hand-washing facilities
<p>Food hygiene</p> <ul style="list-style-type: none"> • Hand-washing • Cleanliness of preparation area, work-top, cooking utensils, and eating utensils • Use of safe water • Washing of raw foods • Placement and protection of stored food • Storage of eating/kitchen utensils
<p>Domestic and environmental hygiene</p> <ul style="list-style-type: none"> • Wiping of surfaces • Sweeping of floors/yards • Control and avoidance of insect vectors • Control/corralling of animals • Safe disposal of animal faeces • Solid waste disposal • Wastewater management

Source: Boot and Cairncross (1993)

Young children in rural Africa spend most of their time in the home or in the vicinities. Therefore they are likely to be constantly exposed to environmental health hazards at household level, which means that they are also likely to benefit highly from actions towards prevention of such hazards.

In many parts of Africa there are activities that rest almost entirely within the hands of women, as a reflection of a clearly defined sexual division of labour (e.g., Katcha & Watts, 2002). Households tend to be the primary loci of

activity for women in such settings. Opportunities to carry out household level preventive behaviours beneficial to young children are likely coincide with such activities, which include bathing, feeding, and supervising children, putting children to bed, food preparation, dishwashing, laundering, cleaning the house, sweeping the yard, water collection, storing, and handling, and livestock management. Indeed in some settings, e.g., Pakistan, women are recognised as the family health providers (e.g., Halvorson, 2004). Therefore emphasis on the female caretaker is crucial in the study of HHEH practices, and hence the primary participants in studies understanding behaviour related to child and family health in general and HHEH in particular.

In health terms, the focus of this study is malaria and diarrhoeal disease in children under 5. As can be seen from Table 1-2, a range of HHEH practices has been identified which could be relevant to either of these health problems. The different facets that these practices might take at the household level are not fully known due to contextual particularities of behaviours. Therefore quantification of patterns of these risk and protective practices across different settings continues to be important.

Further, there is little understanding of what influences people to engage in different forms of HHEH practices. Hence exploring factors associated with the variations in the patterns of behaviours across individuals, households and communities is also crucial.

1.2 Aims and objectives

1.2.1 Aims of the study

The study aims firstly to establish a quantitative inventory of risk and protective environmental health practices within the study population related to childhood malaria and infectious diarrhoea, and secondly to contribute to the understanding of the relationship between wealth and female social status variables and Environmental Health behaviour outcomes.

1. 2. 2 Specific objectives

- Determine the prevalence of relative patterns of practices identified from the literature as being associated with the risk or prevention of infectious diarrhoea and malaria in children under-5.
- Investigate quantitatively associations between household wealth and caretaker's social, economic, demographic characteristics and risk or preventive Household Environmental Health practices.
- To raise post-hoc hypotheses of mechanisms through which factors operate in the production of the behaviours of interest.
- Investigate lay perceptions diarrhoea and malaria aetiology and social values attributed to HHEH practices.

The 2 chapters that follow engage in a critical review of the literature, which leads to the study's conceptual framework, and forms a theoretical basis to address the above research problems.

The thesis is organised in 9 further chapters. Following the literature review on chapters 2 and 3, the 4th chapter is devoted to the study methods. Quantitative results are presented in chapters 5 through 9. A qualitative examination of lay perceptions of HHEH is given in chapter 10. The thesis culminates with the general discussion, conclusion, and implications, presented in chapter 11.

Chapter 2 A review of household environmental health practices suggested to be linked to diarrhoeal disease and malaria

Chapter summary

In this chapter, a literature review is presented which sets out the justification for the choice of behaviour outcomes for the study, provided that diarrhoeal disease and malaria are the health problems of concern to this study. The chapter is sub-divided into 3 parts. The first two review the literature on infectious diarrhoeal diseases and malaria, respectively, describing the scale of these health problems and critically addressing the existing and suggestive evidence regarding the important links between each of these health problems and key EH behaviours. The concluding section selects the HHEH practices to be chosen for further investigation, on the grounds that they are strongly suggested effective interventions for the control of either diarrhoeal disease or malaria.

2.1 Diarrhoeal diseases

2.1.1 Scale and burden of the problem

Diarrhoea is a symptom common to a number of infections caused by a wide range of bacterial, viral, and protozoan pathogens, (Table 2-2). It is characterized by the purging of loose stools at a higher frequency than normal (at least 3 times within a period of 24 hours) (Chin, 2000). Diarrhoea is often accompanied by or results in other clinical signs and symptoms such as vomiting, fever, dehydration and electrolyte disturbances (Chin, 2000).

Diarrhoea contributes to increased susceptibility to other infections and malnutrition, and at the same time the latter health problem contributes to the aggravation of diarrhoea and its consequences. Long term repercussions of diarrhoea include impaired physical growth and cognitive development (Guerrant *et al.*, 1999).

By the 1980s diarrhoeal diseases had been recognised as a leading cause of morbidity and mortality among children under 5 in the least developed countries (Snyder & Merson, 1982). Although diarrhoeal diseases continue to be among the biggest causes of mortality, having killed over 2 million children under-5 in 2000 (Kosek *et al.*, 2003), the mortality figures have recently been on the decrease (Table 2-1).

Table 2-1: Estimated number of deaths per year due to diarrhoeal disease in children under 5 years of age over the last 5 decades

<i>Reference</i>	<i>Period analysed</i>	<i>Global mortality estimate (million)</i>
Snyder & Merson (1982)	1954-1979	4.6
Bern <i>et al.</i> (1992)	1978-1990	3.0
Kosek <i>et al.</i> (2003)	1990-2000	2.5

Around 4 billion cases of diarrhoea occur yearly (Prüss *et al.*, 2002). Estimates from the 1990s were indicative of a global median incidence of 2.6 episodes per child under-5 per year (Bern *et al.*, 1992), a figure that did not differ much from the estimate of 3.0 episodes/child-year, which had been made 10 years earlier (Snyder & Merson, 1982). The most recent systematic review assessing diarrhoeal disease morbidity showed a median incidence of 3.2 episodes per child-year, from 1992 to 2000 (Kosek *et al.*, 2003). Therefore diarrhoeal disease morbidity seems to have been unchanged over the last 4 decades.

Both for the mortality and morbidity estimates above presented, the latter 2 studies (Bern *et al.*, 1992; Kosek *et al.*, 2003) followed Snyder and Merson's methods (1982), but the sources of information were not entirely similar across the three studies, mainly because it is expected that more data

became available over the years. For example the latest study used stricter inclusion criteria (Kosek *et al.*, 2003), the countries included varied from study to study, and while verbal autopsies were used in the most recent studies (Bern *et al.*, 1992; Kosek *et al.*, 2003), the first study made use of certified medical autopsies (Snyder & Merson, 1982). However the authors defended that their estimates were reliable, as comparisons with other analyses that had used different methodological approaches reached similar results (Bern *et al.*, 1992; Kosek *et al.*, 2003), and other critics agree that the trends found were remarkable and could not have been entirely attributed to methodological matters (e.g., Parashar *et al.*, 2003; Victora *et al.*, 2000).

Case management improvement, especially through the implementation of ORT (oral rehydration therapy) as part of diarrhoeal disease control programs in certain developing countries is thought to have contributed to the overall declines in diarrhoeal disease mortality (Victora *et al.*, 2000). Although evidence exists for the efficacy of ORT, with an overall failure rate of only 4% under experimental conditions (Gavin *et al.*, 1996), there is not much solid evidence demonstrating ORT effectiveness, i.e., the impact on diarrhoea mortality in project implementation settings. An example of the scarce attempts to analyse this matter comes from a 13 year-long follow-up study in Bangladesh, one of the countries then considered as leading the way in implementation of ORT promotion initiatives (Behrens, 1993). The study found a significant increase in acute watery diarrhoea mortality in infants (Fauveau *et al.*, 1992), having the authors pointed to incorrect use and failure to reach scale in adoption rates due to complexities in program implementation.

The relationship between ORT implementation and reduced diarrhoea mortality has been reviewed from 4 country case studies, namely Brazil, Philippines, Egypt, and Mexico (Victora *et al.*, 2000). Scarcity of data impaired the review results. Despite this, all 4 countries registered declines in the deaths attributable to diarrhoea, but only the data from Brazil and Egypt could suggest an important impact of ORT on mortality attributable to diarrhoea (Victora *et al.*, 2000). In Mexico, improved water and sanitation were better predictors in

the diarrhoea disease mortality decline. In the Philippines no associations were found between ORT use rates and the observed diarrhoea mortality decline. In Brazil, other factors namely improved water supply, vaccine coverage, breastfeeding rates and nutritional status accounted for only a fraction of that mortality decline, having the rest been attributable to ORT. In Egypt, there were changes in water supply and sanitation but the analysis did not prove that these factors were as important as ORT. With these results the authors made a strong case for the importance of ORT, but results should be interpreted with caution because they cannot guarantee causality (Victora *et al.*, 2000).

In any case, it is difficult to interrupt diarrhoeal disease transmission through case management alone and thus the overall picture of mortality is unlikely to have improved. On the other hand, conceivably it is possible that ORT affords shorter episodes, therefore limiting the time for children to be infective to others and the time losing nutrients, which on the long run could translate into lower morbidity. Despite this reasoning, what underlied the undertaking to attain 80% ORT coverage by 1995 was mortality reduction (Victora *et al.*, 2000), not morbidity, and no empirical account was found regarding the impact of ORT on morbidity.

It is difficult to achieve remarkable reductions in diarrhoeal disease morbidity without addressing preventive approaches, a point that has been brought to the attention of health professionals as early as the late 1970's (Chen, 1978), when the emphasis on Primary Health Care-delivered case management interventions, such as ORT, was at its pinnacle.

2.1.2 Diarrhoeal disease in Mozambique

The latest DHS in Mozambique revealed an overall diarrhoeal disease prevalence of 14% among children under 5 (with a recall period of 2 weeks preceding the survey) (INE *et al.*, 2005). In 1997 the prevalence had been 21% (Gaspar *et al.*, 1998), suggesting that there has been a decline in the prevalence over the years. When stratified by age group, the highest prevalences (23% to 26%) were registered among children between 6 months and 2 years of age,

which is concordant to the global estimates that children between 4 months and 2 years old are those most at risk (Parashar *et al.*, 2003).

In terms of interventions with preventive potential, the most notable and reported has been the national low-cost sanitation program, which began in 1985, initially covering peri-urban areas but later on extending to rural areas (Colin, 2002). This program had its peak of activity in the 1990's and focused primarily on production and selling of latrine slabs. A hygiene promotion component was incorporated, focusing on hand-washing, water management, waste disposal, and latrine use (Colin, 2002). By 1999, sanitation coverage was estimated at 39% (71% urban and 26% rural) (UN, 2000). No evaluation took place to assess the impact on diarrhoea.

A renewed Rural and Peri-Urban Sanitation Strategy envisaged that 50% of rural and peri-urban populations would have adopted improved hygiene practices by 2003 and 75-100% by 2010 (UN, 2000). Although it is widely reported that in Mozambique the majority of population uses unsafe water and engage in poor hygiene and sanitation practices, giving rise to high prevalences of diarrhoea disease (e.g., MPF & UNICEF, 1996; UN, 2000), there have not been published reports clearly quantifying hygiene and sanitation practices in Mozambican communities.

With regards to efforts specific to childhood diarrhoeal diseases, the current strategy of the National Program for the Control of Diarrhoeal Diseases is solely focused on distribution of ORS sachets, encouragement of preparation and use of home-made rehydration solutions, and instructions for mothers and caretakers to increase liquid ingestion and continue feeding children during episodes of diarrhoea (INE *et al.*, 2005).

2.1.3 Transmission of infectious diarrhoea and implications for HHEH behaviour

Though diarrhoeal diseases are caused by a range of taxonomically diverse pathogens (Table 2-2), for many of them humans are the principal

reservoirs (Feachem, 1984), and they have all been identified in faecal specimens from humans. Animals are also important reservoirs for a number of those pathogens, for example *Campylobacter jejuni*, *Salmonella* spp., and *Yersinia enterocolitica* (Feachem, 1984). Therefore the presence of faeces, particularly of humans, in the environment holds potential to be the common ground of transmission of all infectious diarrhoeas.

Table 2-2: Classification of diarrhoeal diseases according to their pathogenic agents

Type of organism causing infection	Infection designation	Infectious agent
Protozoa	Amoebiasis/ Amoebic dysentery	<i>Entamoeba histolytica</i>
	Balantidiasis	<i>Balantidium coli</i>
	Cryptosporidiosis	<i>Cryptosporidium parvum</i>
	Cyclospora diarrhoea	<i>Cyclospora cayetanensis</i>
	Giardiasis	<i>Giardia lamblia</i>
Viruses	Rotavirus diarrhoea/ Rotaviral enteritis	Rotavirus
Bacteria	Campylobacter enteritis	<i>Campylobacter jejuni</i> ; <i>C. Coli</i>
	Cholera	<i>Vibrio cholerae</i>
	<i>E. coli</i> diarrhoea	<i>Escherichia coli</i>
	Salmonellosis	<i>Salmonella enterica</i>
	Shigellosis	<i>Shigella dysenteriae</i> ; <i>S. Sonnei</i>
	Yersinosis	<i>Yersinia pseudotuberculosis</i> ; <i>Y. Enterocolitica</i>

Sources: (Cairncross & Feachem, 1993; Chin, 2000)

Faecal-oral transmission comprises all means through which faecal material coming from one individual enters the mouth of another.

The F-diagram (Figure 2-1), summarises the possible pathways of the faecal-oral transmission and the scenarios where such pathways may occur are given as follows.

Open defecation may result in faecal contamination of nearby surface water, which in turn can be used for domestic purposes. As a result, people face the risk of becoming infected by drinking or washing utensils and foods in such water. Faeces in the fields can contaminate crops, which when ingested offer the potential of infection. Children can also directly ingest faeces lying on the

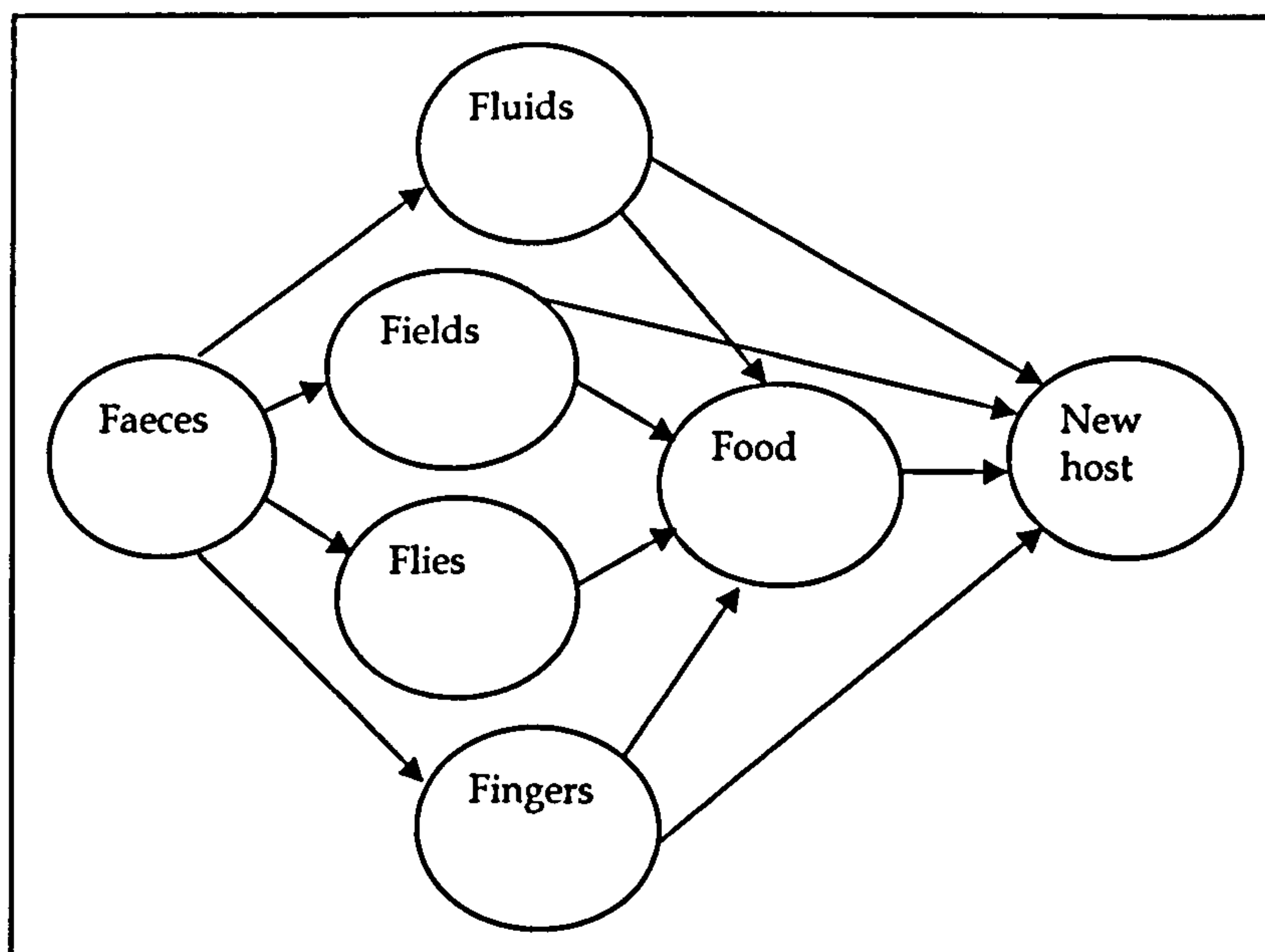
ground, and passers-by can carry faecal matter from the fields to domestic areas through their feet.

Flies constitute vectors of contamination of food with faecal organisms that they pick up from landing on faeces, either through mechanical contact or through swallowing the pathogens and regurgitating them subsequently on food. *Shigella* is transmitted to a significant extent by *Musca domestica* (domestic flies) (Curtis, 1991).

Fingers also act as effective vectors, carrying pathogens from faeces during anal cleansing and passing them to food, utensils or objects which are eventually touched by, and end up in the mouths of, other people and these people become new hosts for the pathogens. Hands can constitute an important mechanism of transmission through direct person-to-person contact (e.g., caretaker-to-child or child-to-child).

The above examples of scenarios where each pathway can occur suggest that most of the transmission risks, especially for children, can occur in the domestic domain, as defined by Cairncross and colleagues (1996).

Figure 2-1: The "F-Diagram": Major routes through which faecal-oral transmission of diarrhoeal disease pathogens can occur.



Source: Wagner & Lanoix (1958)

The conceptualisation presented by the F-diagram does not take into account what happens if one ingests one's own faecal material. This is particularly important for children, as their faeces are considered the most dangerous because they are more frequently infected and likely to have higher concentrations of pathogens compared to adults (V. Curtis, personal communication), and it is the faeces of children that have most frequently been found in the environment (WHO, 1993). At the same time, small children are the ones most at risk of contracting such infections. Women's behaviours are usually of concern as major routes to infection because as children's caretakers they are likely to come into contact with children's faeces and spread them around the home more often.

Lanata and colleagues developed an argument to address the question on whether it is worth worrying about children getting sick from ingesting their own faecal material (Lanata *et al.*, 1998). They held that a susceptible child could only acquire diarrhoea from her own faeces if experiencing a subclinical infection of an organism to which she had not acquired immunity (Lanata *et al.*, 1998). This case has been experimentally proven to be rare (Lanata *et al.*, 1998, citing Levine 1981). Another possibility was that the child would be passing, through her faeces, an organism to which she had immunity, in which case she would not be at risk of diarrhoea. Alternatively, the child would be already experiencing diarrhoea, meaning that ingesting her own faeces would not pose the risk of re-infection. This led to the conclusion that a child is not likely to acquire diarrhoea from her own faeces, but from direct contact from faeces of other children living in the same house because these often defecate on the floor in the same areas where small children play (in the context of Lima), but also from indirect contact with adults' faeces through unwashed adults' hands and food handled by these adults (Lanata *et al.*, 1998). These authors disregarded the role of faeces from households other than the susceptible child's because they held that in Lima, which is a dry setting, such faeces were not likely to be washed away beyond their own households' boundaries. Such would not be the case in rural, tropical Africa. Contamination of the domestic environment

with children's faeces was therefore thought important in this setting because (i) there was the likelihood of finding HH with more than 1 child, and (ii) faeces could be expected to be washed away from house to house by the rains.

The diagram provides a rational basis for the elaboration of a checklist of possible interventions, which can take place at the household level. Amongst them are primary barriers, which inhibit faecal pathogens' escape to the environment (Curtis *et al.*, 2000), and secondary barriers, which target pathogens that are already in the environment on the way to reaching new hosts (Curtis *et al.*, 2000). The following is a list of such barriers:

- Safe excreta disposal (in latrines, or by burying, and keeping domestic grounds free from faecal material including animals' by sweeping)
- Washing hands with soap after contact with faeces and before eating, preparing food or feeding children
- Consumption of water free from faecal contamination (point of use water treatment, protection of water sources and storage vessels)
- Quantities of water sufficient to carry out hygiene practices (e.g., washing hands with soap, and thorough washing of eating and drinking utensils)
- Food hygiene (washing raw food, eating cooked or reheated food, safe food storage, washing hands before handling food)
- Fly management and control (covering the latrine pit, covering food, physical and chemical elimination of flies)

Despite there being numerous interventions capable of targeting biologically-plausible routes of diarrhoea transmission, there is more evidence favouring the effectiveness of some strategies, compared to no evidence for the remaining. Evidence, from the epidemiological perspective, for the protective effect of interventions aimed at interrupting diarrhoeal disease transmission is discussed as follows.

Excreta disposal: Toilets and latrines offer a physical barrier between faeces and the environment, thereby interrupting the routes that transmit diarrhoeal disease pathogens to humans through fluids and fields. Certain sanitation technologies, for example flush toilets and VIP latrines, can decrease contamination of the environment through flies.

Esrey and colleagues, who carried out a review of 144 studies on the impact of different components of improvements in water and sanitation on diarrhoeal disease morbidity, identified 11 studies that had focused on sanitation, which together revealed a median reduction of 22% in diarrhoeal disease morbidity. Singling out the more rigorous studies (5 studies) improved the reduction to 36% (Esrey *et al.*, 1991).

The latest systematic review by Fewtrell *et al.* (2005) also produced a median estimate of the effect of interventions to reduce diarrhoeal disease through improvements in sanitation facilities. The results, based on only two studies from the Philippines and Botswana, one of which was of poor quality, gave a pooled relative risk of 0.68 (0.53-0.87), or 32% (47-13%) reduction in the risk of disease (Fewtrell *et al.*, 2005). Despite the fact that one of these studies had included promotion of safe disposal of faeces in the hygiene education that accompanied the latrine installation program (Daniels *et al.*, 1990), none of the above studies directly measured faecal contamination of the domestic environment or stool disposal behaviours. Mere installation of a latrine may not necessarily translate in reduction of risk to diarrhoea in children in the household. For instance, latrine ownership was not shown to be associated with diarrhoea in a case-control study from Nicaragua (Gorter 1991).

In addition, a number of non-intervention studies (case-control studies) investigated the link between stool disposal practices and diarrhoea disease outcomes. Ghosh reported that indiscriminate disposal of children's stools was associated with diarrhoea in West Bengal (OR 1.99, CI 0.97- 4.08) (Ghosh *et al.*, 1997). In Bangladesh, more cases (86%) than controls (36%) of diarrhoeal disease were found in households where children were observed performing

open defecation in or around the house (Clemens & Stanton, 1987). Reported unsanitary disposal of children's faeces was associated with 34% increase in risk of diarrhoea (OR 1.34) in the Philippines (Baltazar & Solon, 1989). A study in Burkina Faso found that reported unsafe disposal of children's stools (not in the latrine) was associated with 50% increase in the risk of hospitalisation due to diarrhoea (OR 1.5 CI 1.09- 2.06).

The above case-control studies were of use to demonstrate the importance of safe stool disposal behaviour in the prevention of diarrhoea besides the mere improvement of sanitation facilities. However, as has been criticised by Curtis (1998) case-control studies have the problem of confounding. They cannot control for factors such as caretaker's general attitude to hygiene, which might be the key factor explaining both child's diarrhoea status and hygiene practices. Notwithstanding this weakness, case-control studies on risk factors for diarrhoea disease have been said to produce valid estimates of effect and in case the estimates cannot be conclusive they offer good suggestive evidence (Baltazar *et al.*, 1988).

Despite the small number of intervention studies and the problems that case-control studies cannot address, Fewtrell's and Esrey's reviews of intervention studies are concordant and, together with the non-intervention studies, point to a positive association between improvements in sanitation and reduction of diarrhoeal disease.

Hand-washing: Hand-washing with soap after potential faecal contact (e.g., anal cleansing) interrupts the route of faecal contamination through food and direct person-to-person contact.

There have been a large number of observational and a few intervention studies to test the impact of hand-washing. Huttly *et al* (1997) calculated that hand-washing was associated with 35% median reduction in diarrhoea incidence from 5 studies from USA, Burma, Bangladesh, India, and Indonesia. A recent meta-analysis included 7 intervention and 10 observational studies, of which 10 were set in Asia, 3 in Africa, 2 in Latin America, 1 in the USA and 1 in

Australia. None of the intervention studies were RCTs. Taking into account the intervention studies, this analysis showed that hand-washing with soap reduced the risk of diarrhoea by 47% (24-63%) (Curtis & Cairncross, 2003). When all good quality studies of hand-washing with soap were included, the reduced risk of diarrhoea was estimated to be 42% (31-51%) and when the use of soap was specifically mentioned the risk reduction was 44% (Curtis & Cairncross, 2003).

Despite their striking finding, especially the fact that a consistent pattern of impact was found across analyses combining particular types of studies, the authors identified weaknesses in the existing evidence, namely the range in the results was wide, a mixture of interventional and observational studies were included, and the studies had been poorly designed, with possible but not substantiated publication bias, hence calling for more high quality intervention trials in developing countries (Curtis & Cairncross, 2003).

A meta-analysis of 5 hygiene interventions in Bangladesh, Myanmar, India, and Indonesia, specifically focusing on hand-washing promotion, revealed a pooled estimate of a relative risk of 0.56 (0.33-0.93), which can be translated in 44% reduction (67-7%) in diarrhoea (Fewtrell *et al.*, 2005). As shown, a considerable range in the results was detected. These studies are all Asian; therefore the evidence is not entirely relevant to the understanding of the African context.

Nonetheless the magnitude of the central point was consistent with the earlier meta-analysis by Curtis and Cairncross (2003), but not surprising because the studies included also featured in the earlier analysis. This study differed from that of Curtis and Cairncross (2003) in that it focused on interventions in developing countries only, and additionally calculated the impact of other hygiene interventions not particularly focusing on hand-washing.

Luby and colleagues (2005) contributed a further step in understanding the impact of hand-washing with soap, exclusively in children under 5, by conducting an RCT involving 906 households from low income

neighbourhoods of Pakistan. Children from neighbourhoods that had been targeted by hand-washing promotion and provision of soap experienced 53% lower incidence of diarrhoea (95% CI 65-41%) than the control group, which had received regular supplies of stationary for the children. When comparison was restricted to infants, a 39% (95% CI 61-16%) reduction in diarrhoea was determined. Results did not differ if soap was plain or anti-bacterial.

The major limitations from the above study were: firstly, the trial was not blinded, opening the possibility that respondents, and fieldworkers, from the intervention arms under-reported diarrhoea; secondly, hand-washing behaviour was not directly measured. Instead, it was assumed that hand-washing took place at higher frequencies in the intervention groups from registering higher soap consumption by families within those groups. However, soap could have been used for other purposes. Finally, it was possible that regular visits by fieldworkers to promote hand-washing led to changes in other favourable behaviours for diarrhoeal disease reduction (Luby *et al.*, 2005).

Despite the fact that more intervention studies are needed in developing countries to assess the impact of hand-washing on diarrhoeal diseases, consistency in the evidence, particularly from intervention studies, is on the rise to suggest a significant protective effect of hand-washing on diarrhoeal disease.

Water supply, handling, storage, and use: Protected water sources provide a reinforcement to impede faeces in the environment from getting into fluids. Tubewells and boreholes, which are protected from pollution by concrete slabs, are considered improved water sources as opposed to open hand-dug wells or surface water (Cairncross & Feachem, 1993). Therefore it should follow that consumption of water from improved water sources effectively reduces diarrhoea. However, Fewtrell's analysis (2005) did not support the hypothesis that interventions to improve water supply significantly reduce diarrhoeal disease.

The benefits of uncontaminated water sources can be lost in places where there are no house connections. It was shown in Bangladesh that although

handpump water was of good quality at source (1.6 faecal coliforms/100 ml), when water from the same source was stored at home suffered contamination, with measurements reaching more than 1000 faecal coliforms/100 ml (Aziz *et al.*, 1990). Handling water with contaminated hands, using drawing objects with no handle, and storing water in unclean and uncovered receptacles could have contributed to this loss of water quality provided at source. Therefore interventions to reduce such risks can be argued as more relevant in the context of household environmental health. Of course this may depend on how polluted the water at source is. If it is too polluted, then the effort to avoid contamination whilst handling and storing water becomes irrelevant if water treatment is not addressed.

A 1-year prospective study in Pakistan investigated both the role of water quality at source and at point of use, showing no evidence for the association between incidence of childhood diarrhoea and bacteriological quality of drinking water at source, and weak evidence for the association between the quality of the water from domestic containers and diarrhoea incidence (Jensen *et al.*, 2004), adding some support to the idea that quality of the water source can become unimportant if water handling and storage practices at home are unsafe, but also adding evidence to the point of view that pathogens introduced in the home might not pose significant dangers. This is in line with the argument that contamination at home is not relevant because it exposes householders to their own pathogens, which pose minor threats (Curtis *et al.*, 2000). If household pathogens were not important risks, then contamination via other routes (e.g., hands) would also be irrelevant, which is a contradictory point to the current discourse regarding the role of hand-washing after handling faeces to protect other people in the same house (Curtis *et al.*, 2000). Perhaps the only argument that stands as plausible for the minor role of water contamination at household level is the fact that microbial pathogens dilute in water and die off with time, such that infective doses can difficultly be sustained in drinking water (Cairncross & Feachem, 1993).

The water quality/quantity argument was set forth by Esrey *et al* (1991), when their review revealed that improved drinking-water quality did not offer as much an impact on diarrhoeal disease as appropriate water use for hygiene. However, these authors did not include studies specifically measuring water quality improvements at point of use. Cairncross and Feacham reported studies that showed a drop in diarrhoeal disease associated with increased availability of water and increased volume of water used, but increased quality of water did not significantly relate with diarrhoeal disease outcome (Cairncross & Feachem, 1993). The reason for some authors to consider water quantities to be more important or as important as water quality in reducing transmission of diarrhoeal disease, is that increasing water can translate into more frequent hygiene practices such as hand-washing (Esrey *et al.*, 1991). Some authors have even argued that some diarrhoeas (e.g., shigellosis) are primarily water-washed, that is their transmission is almost entirely reduced with an increase in water use for hygiene (Cairncross & Feachem, 1993).

In an intervention-control study in Bangladesh, children (between 6 months and 5 years of age) in the intervention area enjoyed 25% fewer diarrhoea episodes compared to the control area (Aziz *et al.*, 1990). Within the intervention area, children living closer to handpumps experienced less diarrhoea, and increased distance of the household from the handpump predicted lower water consumption. This could have two meanings: either the new practice of using handpump water was translated into diminished consumption of lower quality water (i.e., from unprotected sources), in other words, the issue of water quality was addressed, or households located closer to handpumps were consuming more quantities of water for domestic hygiene, therefore tackling the matter of water quantity. Although both mechanisms could be playing a role in protection from diarrhoea, the authors only considered the second. Nevertheless the authors recognised that their measurements of water quantity were not reliable (Aziz *et al.*, 1990) as a justification for their negative result on a further analysis of the direct link between increased water use and reduction in diarrhoea.

Recently, the argument for the importance of the quality of water in diarrhoeal disease control has received increasing attention, with particular focus on improved point of use water management, which includes treatment and preservation of drinking water (Clasen & Cairncross, 2004). In the meta-analysis by Fewtrell *et al.* (2005), it was determined that the improvement in the safety of water at the point of use gave a relative risk of 0.61 (0.46-0.81) or risk reduction of 39% (54-19%), when good quality studies only were included. The range in the protective effect is wide, and it should be noted that studies reporting a wide range of approaches were included such as chlorination, solar disinfection, safe storage, and filtration, offering weak grounds for comparisons.

In sum, there is better evidence for the importance of water quality at point of use than there is for water protection at source, both in terms of plausibility for the argument and in terms of quality of reviews conducted and quantity of studies on the subject. However, studies assessing whether the impact of improved water quality at source or water treatment at point of use may vary according to different levels of pollution were not found. Moreover, there are different ways to achieve and preserve water quality at point of use, including storage, treatment, and handling practices, the relative importance of the different methods is unclear.

In terms of water quantities, the measurement of the variable itself is still problematic, which limits the quality of the empirical evidence which remains conflicting.

Fly control: Under trial conditions the control of domestic flies through insecticide application showed significant reduction in diarrhoea. In a trial in Pakistan, villages that were randomly assigned to insecticide application experienced virtual elimination of the fly population and a 23% reduction in the incidence of diarrhoea in children under-5 (Chavasse *et al.*, 1999). Similarly, insecticide application in The Gambia resulted in a reduction in the fly

population by 75% and 22 to 26% fewer diarrhoea cases in children between 3 months and 5 years, compared to the control villages (Emerson *et al.*, 1999).

Much effort has been put in place for the development of flytraps (Curtis, 1991). However, there have been conflicting results with regards to the impact of this approach. Under trial conditions the effectiveness of baited fly traps in the control of flies, and hence diarrhoea, has failed to be demonstrated in one setting (Chavasse *et al.*, 1999). Conversely, the same technique reduced fly counts by 64%, and clinical visits reduced significantly for shigellosis but not for diarrhoea in general (Cohen *et al.*, 1991).

It is generally agreed that the effectiveness of both of the above forms of fly control have yet to be demonstrated outside controlled trials, and there are not yet good prospects for the sustainability of such interventions (Curtis, 1991; Curtis *et al.*, 2000).

Use of latrines as simple as pit, unventilated latrines has been pointed as an effective control measure of *Musca sorbens* (Emerson *et al.*, 2000; Emerson *et al.*, 2005), an important transmitter of trachoma (Prüss & Mariotti, 2000). These flies breed on human faeces but only on those that are exposed in the open (Emerson *et al.*, 2000). However the role of this fly in transmission of diarrhoea has only been speculated (Prüss & Mariotti, 2000).

The evidence is not strong as to the role of fly control, as few studies exist that reported the relationship with diarrhoeal disease reduction. While insecticide application showed a positive balance of evidence toward diarrhoea disease control, flytraps and latrines have not. Neither of the already tested approaches has been replicated beyond trial conditions.

Food hygiene: As seen in Figure 2-1, there are various ways through which food can be contaminated with diarrhoeal disease pathogens. Important pathways through which this contamination can be avoided include securing the previously discussed primary barriers (i.e., hand-washing after stool contact and safe disposal of stools) and all the secondary barriers, which include fly control, hand-washing before preparing food, before eating and before feeding

children, washing of utensils and food eaten raw, as well as heating and re-heating of food.

A review of epidemiological evidence for the impact of food hygiene on diarrhoeal disease in developing countries was brought to an inconclusive close (Curtis *et al.*, 2000).

Many studies focused on microbiological evidence of presence of pathogens in food have been reviewed (Esrey & Feacham, 1989). Behavioural studies examining associations between specific food hygiene related behaviours and diarrhoeal diseases provided imprecise evidence. There has been a call for further studies to clarify the role of food contamination in diarrhoea disease transmission (Curtis, 1998). Specifically, the relative impact of each of those behaviours is not known. Overall the evidence for specific food hygiene practices in the homes in relation to diarrhoea is inconclusive.

Animals: The role of animals in the transmission of diarrhoea is two fold. First, similar to flies, they can act as vectors, which facilitate the contamination of the environment with human faecal material (Curtis *et al.*, 2000; Huttly *et al.*, 1994). Second, their own faeces contain diarrhoeal disease pathogens.

Curtis *et al* (2000) built their argument regarding the possible link between animal faeces and human infection based on 4 studies, 3 of them showing an association between presence of animals in the house and increased childhood diarrhoea, but one showing an apparent protective effect. However, presence of animals in the house was not a direct measure of human contact with animal faeces. It could also mean that those animals were acting as vectors for the spread of human faecal material. Moreover, Curtis' argument continues stating that if any effect animals should have in the spread of human faeces it would be a beneficial one because of their faeces eating-habit. This is not a convincing argument, and is precisely opposing to what is being argued here. It seems more plausible, and was reported in Peru (Huttly *et al.*, 1994) that by eating human faeces, animals (e.g., dogs, pigs) are likely to carry the pathogens in their snouts to other surfaces in the domestic environment.

Lanata and colleagues reviewed 3 studies on the role of animal faeces in the particular context of Lima (Lanata *et al.*, 1998). Such studies showed that dogs' faeces were less likely to contain human enteropathogens compared to chicken's faeces which contained *Campylobacter jejuni*, but none of the studies directly measured associations between contact with animals' faeces and diarrhoeal disease outcomes.

The argument for the role of animals as spreaders of diarrhoeal disease pathogens is plausible, but the evidence for that is indirect and not conclusive, particularly because studies are scarce and there have not been studies reporting the relationship between contamination of the domestic environment with animal faeces and diarrhoeal disease nor there are studies reporting the relationship between animal contact with human faeces and that disease outcome.

2.2 Malaria

2.2.1 Scale and burden of the problem

Malaria is a deadly parasitic disease caused by an infection by the protozoan of the genus *Plasmodium*. Humans can be infected by 4 species of plasmodium, namely *P falciparum*, *P vivax*, *P ovale* and *P malariae*.

Malaria has been described as the most important insect-borne disease (Curtis, 1989). Globally the number of clinical malaria cases is 300 to 500 million per year and the disease is responsible for at least 1 million deaths per year (Greenwood & Mutabingwa, 2002).

The greatest burden of this disease is in developing countries, particularly in Africa, where malaria remains one of the top causes of morbidity and mortality. Around 200 million clinical episodes are registered in Africa each year, the great majority of which in children under 5, mostly in rural areas of Sub-Saharan Africa (Snow *et al.*, 1999). It was estimated that throughout the

1990's 20 to 30% of deaths in African children (from 0 to 4 years) had been attributable to malaria (Snow *et al.*, 2001; WHO, 2001).

This disease can make children more susceptible to diarrhoea and respiratory infections, therefore indirectly increasing its contribution to mortality. On the long run children suffer from nutritional disorders and poor development due to malaria (WHO/UNICEF, 2003).

Malaria control in Sub-Saharan Africa has been considered as one of the world's greatest public health challenges (Mabaso *et al.*, 2004). Alonso and Dgedge (1999) have described the current lack of control of malaria in sub-Saharan Africa as unacceptable. Drug resistance of the parasite, especially to chloroquine, has been pointed out as responsible for the aggravation of the problem of malaria being out of control (Trape *et al.*, 2002), one reason for experts to believe in the important role that vector control approaches can be played compared to others (e.g., Curtis, 1991). Efforts for the control of malaria, with emphasis on household environmental health interventions, are discussed below.

2. 2. 2 Malaria in Mozambique

Malaria is endemic in Mozambique, where it accounts for 40% of out-patient consultations and 60% of paediatric admissions (MISAU, 2005). An analysis of the burden of disease across all age groups in Maputo, the capital city of Mozambique, revealed that malaria was the second leading cause of death in the total number of deaths registered in 1994 (Dgedge *et al.*, 2001). However, these indicators are likely to be misrepresentative of the current burden of malaria in the country because of the issue of selectivity, in other words, the above figures are only relative to malaria among health care service users. Further, most studies measuring malaria in Mozambique have occurred in urban areas (Thomson 1997; Mendis 2000; Dgedge 2001), where no more than 30% of the population lives. It is expected that the situation should be worse in rural areas, given that in Africa these areas are more at risk compared to major cities (Donnelly *et al.*, 2005).

In the case of Southern Mozambique *P falciparum* is responsible for over 90% of all infections and the remaining are due to *P malariae* and *P ovale* (Saute *et al.*, 2003).

The major strategies established by the Ministry of Health are prompt access to correct treatment at low cost, promotion of access to ITNs by pregnant women and children, and delivery of intermittent presumptive treatment (IPT) to pregnant women (MISAU, 2005). However, there have not been reports of the latter two interventions in circumstances other than clinical trials in the country.

Household-level mosquito protection in Mozambique has been described (Dgedge, 2000; Munguambe, 2001). Although there is little experience of sleeping under bednets in Mozambique (Dgedge, 2000), let alone ITNs, people actively address the problem of mosquito bites using traditional methods. The burning of biomaterials (e.g., eucalyptus leaves, cow dung, and corn cobs) is widely practiced in rural areas. In the southern provinces of Mozambique this technology is named *sule* (Munguambe, 2001).

2. 2. 3 Malaria transmission and implications for HHEH behaviour

Malaria is transmitted from person to person through mosquito bites. The involvement of a vector in transmission means that it is important to understand the relevant behaviours of the vector.

Many genuses and species of mosquitoes exist, but only *Anopheles* spp. transmits malaria. When a female *Anopheles* takes a blood meal that contains the *Plasmodium* parasite in its sexual stages (gametocytes), sexual reproduction and maturation of the parasites take place in the stomach of the mosquito, ultimately producing sporozoites, which when migrate to the insect's salivary gland, become ready to be released to a new host during a subsequent blood meal. In the human host, the sporozoites migrate to the liver where they undergo a series of differentiations and multiplications ultimately resulting in merozoites, which invade the red blood cells and go through cycles of multiplication and differentiation eventually producing gametocytes. It is during this invasion that the human host suffers the malaria symptoms (fevers, etc.). During an eventual blood meal the gametocytes are sucked up by a female Anopheline and the cycle of transmission re-starts (Knell, 1991).

The control of malaria aims at interrupting the above cycle. The main approaches that have been used in order to control malaria in Africa are elimination of mosquito breeding sites, killing larvae and adult mosquitoes, using mechanical barriers to prevent contact between mosquitoes and people, and treatment of clinical cases. The latter is the current approach for malaria control in most affected countries (Snow *et al.*, 2001), the effectiveness of which depends on early diagnosis and prompt treatment which is widely advocated by WHO.

All but one of these strategies comprise environmental health practices, in other words efforts to modify the environment to reduce the breeding, feeding, and resting opportunities for the vector. Each of these practices is discussed in turn.



Elimination of mosquitoes: There is a variety of Anopheline species differently distributed in the malaria-affected areas, and requirements for breeding sites and resting places vary from species to species. For example, *Anopheles gambiae* and *A. funestus*, the principal malaria vectors in Mozambique (Mendis *et al.*, 2000; Michel *et al.*, 2005), breed in fresh water outdoors (Curtis, 1991). Therefore it would be inappropriate to reinforce the environmental measure of clearing polluted ponds for malaria control. At the same time, clearance of vegetation, a widely recommended practice aiming to reduce the vectors' resting places, is now considered inappropriate because vegetation has been established as not being the usual resting place for Anophelines (Curtis, 1989).

The use of indoor residual spraying (IRS) with DDT was widely advocated in the 1950s, with good results through the 1960s in the developed world (Mabaso *et al.*, 2004). In colonial times, and again in the 1980s, similar efforts took place in many African countries, including Mozambique (Schwalbach & de la Maza, 1985). These interventions were proven extremely successful at decreasing malaria morbidity by up to 50%. For example, in Mozambique it was registered that following a residual spraying program, parasite rates in infants declined from 63% in 1953 to 24% in 1955 (Mabaso *et al.*, 2004, citing Soeiro 1956).

Despite the potential of bringing large impacts in terms of morbidity reduction, DDT failed at interrupting malaria transmission in many African countries. A review of the evidence for the impact of this approach in Southern Africa revealed a decreasing trend in the impact of IRS due to environmental, climatic, biological, and social limitations, such as civil wars and inefficient governance, which impeded sustainability of such programs (Mabaso *et al.*, 2004). Following such failures, a renewed interest in long-term malaria control emerged in the 1980's, creating a need to revisit existing effective tools.

Bednet use: In general, *Anopheles* mosquitoes tend to bite people between 10pm and 5am (Pates & Curtis, 2005), when people are most probably in their houses sleeping. Therefore houses are potential target sites for mosquito control practices and bednet use can significantly reduce the feeding opportunities for the vector on people. It was found in the Gambia that bednets, where they had been used correctly, reduced the number of blood-fed mosquitoes inside rooms (Port & Boreham, 1982). However it is not always the case that mosquito-biting hours completely coincide with the sleeping patterns of people, nor with people being at home. For example, there are those going to bed late and those setting out at dawn. This offers limitations to the effectiveness of bednets.

Untreated nets (UTNs) accounted for weak protection from malaria in the Gambia and Papua New Guinea (Bradley *et al.*, 1986; Campbell *et al.*, 1987; Genton *et al.*, 1994). In contrast, an intervention trial of two arms in the Gambia, one of 7 randomly selected villages to which bednets were allocated (and its use was monitored) and the other of 9 villages with no bednets, pointed to no effect of UTNs on malaria morbidity (Snow *et al.*, 1988). Regarding the contrasting results, the latter authors argued that the previous studies where protective effect was found compared within the same village UTN users with non-users. In this case, diversion of mosquito feeding towards non-bednet users could have explained an increased malaria risk amongst those unprotected rather than a decrease in the risk amongst UTN users (Snow *et al.*, 1988). In Snow's study whole villages were either protected or unprotected therefore this phenomenon was not observed (Snow *et al.*, 1988).

UTNs were later shown to offer some protection against malaria. Although in general less malaria was observed in children sleeping under UTNs in good condition compared to those with no nets, when stratified by SES (3 strata), a 62% reduction in *P. falciparum* parasitaemia was observed in children using a good UTN compared to those not using any net (Clarke *et al.*, 2001), and the protective effect was only observed within the poorest socio-economic group. These authors pointed to 5 studies which had suggested a protective effect of UTNs, but such studies were cross-sectional, where users

had been self-selected and various confounding effects could have been operating (Clarke *et al.*, 2001).

Although the suggestions were promising in favour of UTNs, further UTN trials, perhaps to clarify some of the earlier identified issues of confounding, were foreseen unlikely since the evidence for impact of more effective tools against mosquito bites was already gaining currency, encouraging malariologists to abandon their interest in UTNs (Clarke *et al.*, 2001). A number of factors limit the usefulness of UTNs, namely torn nets, badly installed nets, and the ability of mosquitoes to bite through the net (Curtis *et al.*, 1989). Snow *et al.* (1988) documented that when observing individuals sleeping under UTNs through the night, over 30% of them got up at least once, which besides exposing themselves to mosquito bites outside the net, facilitated mosquito entry to the net.

The use of insecticide-treated nets (ITNs), which can overcome problems such as those created by holes or limbs touching the net, has been shown to be one of the best approaches for reducing malaria mortality and morbidity. A review of 5 trials in African settings with stable malaria where mortality in children under five was measured revealed a summary relative risk of 0.82 when ITNs were compared with UTNs together with no nets, an 18% risk reduction (Lengeler, 2004). Comparing UTNs with ITNs, the relative risk of child mortality was 0.77 (22% risk reduction). ITNs also reduced the incidence of mild malarial episodes by 48% (compared with no nets) and 34% (compared with UTNs). The evidence for the effect of ITNs is strong, with high homogeneity between sites, both in terms of mortality and morbidity.

Despite having been demonstrated as one of the best tools for preventing malaria, findings from an analysis of DHS data from 30 malarious countries indicate a low coverage, which is consistent across Africa. Proportions of children sleeping under an ITN range from less than 1% (registered in Swaziland) to just over 20% (registered in São Tomé & Príncipe) (Monash *et al.*, 2004).

Many people at risk are from the poorest segments of developing countries' populations, who have no access to and cannot afford these effective products. On the other hand, governments of these countries do not have the means to provide free or heavily subsidised ITNs (Dgedge, 2000).

Even if ITNs are made available, insecticides may not be available for subsequent treatments of the nets. The result is for example that UTNs remain more common amongst bednet users in Africa.

One important drawback from ITN use, as the case of UTNs, is that they still allow exposure to mosquito bites whilst the individual is not in bed during mosquito biting hours. Therefore people might feel the need for further protection at these times, which is discussed below.

Other mosquito deterrence products: The use of at least one alternative commercially available form of prevention from mosquito bites has been reported in many parts of Sub-Saharan Africa, either as a complementary method to bednets or as a first available or affordable option. Aerosol sprays and mosquito coils are widely used for this end (Evans, 1994; Lines *et al.*, 1989; Ziba *et al.*, 1994).

Aerosol sprays, which mostly contain pyrethrins as the active ingredient, offer rapid knockdown of mosquitoes. However, these mosquitoes can sometimes recover. Further, because they have no residual effect, there is a risk of more mosquitoes getting into the sprayed quarters later (Curtis *et al.*, 1989). Therefore aerosol sprays can only be useful to momentarily clear quarters from mosquitoes if they are screened. Trials specifically addressing the question of whether the use of aerosol sprays is protective towards malaria have not been found.

Mosquito coils, which are spiral devices made from a range of materials from pyrethrum flowers to DDT, can smoulder at a steady rate for up to 8 hours (Lawrance & Croft, 2004). The smoke produced helps to spread the insecticide throughout the room and this is believed to both knock mosquitoes down and reduce the landing rate on humans. As seen with aerosol sprays, with coils

there is the risk of mosquitoes recovering later (Lawrance & Croft, 2004). However compared to other pyrethroid products, the room needs not to be screened for mosquito coils to take effect (Curtis *et al.*, 1989).

Burning of mosquito coils is recommended to tourists visiting endemic areas for protection against malaria. However, a systematic review has found no trials of mosquito coils that measured disease outcomes (Lawrance & Croft, 2004). This review of 15 trials, from laboratory and field settings, reporting on the effect of mosquito coils, revealed the following outcomes: mosquito bite reduction, repellence, deterrence, knockdown effect, and mosquito mortality. The conclusion was that coils were consistently shown to be effective in reducing the number of bites received by the host in the immediate vicinity of the burning coil, and that the other outcomes showed mixed results (Lawrance & Croft, 2004). The available data however did not allow for quantification of the magnitude of this effect. It could not be inferred that the reduction in bites would automatically translate into a clinical impact, since one infective bite is enough to transmit malaria. Finally, there was no indication as to the countries or settings in which the field tests took place.

Although there is no solid direct evidence for the effectiveness of mosquito coils towards malaria control, they continue to contribute to an industry worth of billions of dollars (J.D. Lines, personal communication). This suggests that there is considerable demand for mosquito coils and such a large market reflects the magnitude of consumption, which means that the consumers may be seeing some benefits from using these products.

Besides mosquito coils and aerosol sprays, rural African households use traditional methods such as burning of herbs and other organic materials (Evans, 1994; Macheso *et al.*, 1994; Ziba *et al.*, 1994). A great limitation in testing the effect of traditional mosquito repellents, such as plants, is that scientific experiments tend to test the effectiveness of single active chemicals of certain plants in the lab. It has been argued that they should instead aim at replicating the traditional practices that involve the use of such plants as they happen *in situ* and testing their effects (Lines *et al.*, 1989). The few epidemiological studies

of traditional repellents that have taken place have not been able to offer empirical proof that these methods are effective against malaria. A cross-sectional study in the Gambia showed no differences between *churai*¹ users and non-users in terms of malaria in children (Snow *et al.*, 1987).

In summary there is no epidemiological evidence of the protective effect of aerosol sprays, coils or traditional burning of herbs in terms of malaria outcomes.

Housing: Variations in malaria incidence within communities have been reported in malaria endemic countries, suggesting the relevance of factors operating at the local level. Most factors described to be associated with local protection, which may account for the variations in incidence over short distances, operate at household level (Schofield *et al.*, 1989). Besides variations in breeding sites or in the use of insect repellents and mechanical barriers against mosquito contact, house position and/or design can also be important.

In Tanzania, lower levels of anaemia linked to malaria were proved associated with living in bricked houses compared to mud walled houses (Kahigwa *et al.*, 2002). Neither did this analysis control for wealth nor for house location, which could be taking part in the explanation for the observed association.

Additionally, it was found in Sri Lanka that, independent of house location, malaria incidence was nearly 2 times greater in inhabitants of the poorest type of house construction (incomplete, mud, or palm walls, and thatched roofs) compared to houses with complete brick and plaster walls and tiled roofs (Gamage-Mendis *et al.*, 1991). This study was the first that separated location from construction quality, as people that can afford improved housing tend to live in the middle of villages, whereas the less advantaged families concentrate on the outskirts where mosquitoes tend to congregate (J.D. Lines, personal communication). These associations were not controlled for other wealth variables. Nonetheless, in Sri Lanka mosquito densities found in houses

¹ Aromatic organic materials burnt for the purpose of repelling mosquitoes in West Africa

of better construction were significantly lower than those in poorly constructed houses, suggesting higher malaria risk in the latter quality of construction (Gamage-Mendis *et al.*, 1991). Similarly, in a filariasis project in Tanga it was shown that building ceilings to reduce eaves spaces reduced the entrance of Anophelines (Kolstrup *et al.*, 1981).

Besides backing up the suggestion of a positive association between indoor mosquito vector densities and presence of eaves gaps, an aspect of house design was shown relevant in São Tomé (Charlwood *et al.*, 2003). Repeated measurements of mosquito density revealed an 18-fold increase in mean densities of *An. gambiae* per night in a house built on the ground compared to a house, 5m away, raised on stilts, implying that even households within close range of each other could have different exposure levels to malaria vectors.

Despite the conforming findings pointing to the importance of housing design as an environmental measure against malaria, the major limitation to establishing the evidence has been the difficulty in establishing a direct causal pathway. Sorting out confounders has been difficult, and the results cannot assure that (i) malaria risk is higher in people living in poor housing because of higher mosquito contact and not because of other factors such as nutrition, and (ii) even if more mosquitoes are found in these houses, there is no evidence to prove that presence of more mosquitoes is associated with more malaria.

Nonetheless, this mounting evidence proposes the significance of documenting the range of house construction designs existent in malaria-prone communities in order to better identify and target households that are more vulnerable to mosquito entry. If house design is clearly associated with likelihood of mosquito entry, it can be an important factor affecting mosquito deterrence practices. There is the potential to encourage personal or household protection when larger-scale approaches for controlling the mosquito population from the area are deficient or nonexistent.

Greenwood (1999) criticised the fact that little attention has been paid to local measures of malaria control, particularly in terms of provision of personal protection against mosquitoes and the effectiveness of such actions. The

following contemplation reflects the most likely scenario in rural Mozambique and many malaria-prone parts of Africa, which offers reason for continuing to investigate many aspects of mosquito deterrence, namely those proven effective and the locally available alternatives:

“A method which is freely available and of small benefit may be more useful than one which is more effective but unavailable” (Lines *et al.*, 1989).

2.3 Conclusion

The literature review allowed for the practices related to diarrhoeal disease and malaria transmission to be considered and relevant ones to be picked out for further investigation of interest to the study of HHEH. The behaviour outcomes of interest to this study were chosen provided that they:

- Belong to, or are alternatives to, the group of strongly suggested effective interventions for the control of either diarrhoeal disease or malaria.
- Occur as a result of household-level efforts
- Have potential for behaviour change

Hand-washing with soap and safe disposal of human stools have been strongly suggested to be relevant to the control of infectious diarrhoeal disease. Evidence of the role of water quality at point of use is on the rise but not as established. Further, it was predicted that practices to ensure water quality at point of use are unlikely to be observed in this setting.

The literature shows that ITN use is an effective household level intervention against malaria, but predicts that it is not the most common practice among the proposed study setting. However, the literature accounts for other practices such as the use of untreated nets, coils and traditional smoky repellents, which although not proven as effective at combating malaria, can be playing a part in reducing the burden of mosquito-human contact. These

practices deserve to be explored in terms of what accounts for the patterns found in their use and the motivations for their use. Factors underlying use of alternative mosquito deterrence products can shed light in the understanding of willingness to use empirically proven more effective methods.

Chapter 3 A review of factors likely to influence household environmental health practices

Chapter summary

This chapter presents the second part of the literature review conducted for this study. The section following the introduction looks at previous research that has addressed predictors of risk and protective health behaviours in general and those that the study investigates, justifying the importance of such factors for this study. The 3rd section summarises the key points of the review and highlights some gaps in knowledge to be addressed in the field of HHEH and leads to the final section, the conceptual framework, which highlights important possible links between the identified factors and the HHEH practices of interest to this study.

3.1 Introduction

As highlighted section 1. 1, HHEH encompasses actions and conditions that can provide hazard free environments within the homes, with preventive potential over killer infectious diseases, which include malaria and diarrhoeal disease.

Interventions to promote safe EH practices have been documented widely. A range of approaches has been applied, from the classic health education process, where emphasis is given to disease aetiology, through to social marketing, which focuses on creating a demand for the behaviour in question, often exploiting non-health drives for behaviour change. Messages to promote behaviour change may or may not be complemented with the

provision of EH resources such as soap, latrines, improved water sources, water storage containers, and bednets.

In most settings however, regardless of whether any intervention has taken place, the observation of protective practices from the public health perspective, is not homogeneous across populations at risk. It is not fully known why certain people perform such practices and others do not. There are even intra-individual variations of behaviours that cannot be explained. Understanding reasons underlying such differences in patterns of human behaviour is important for intervention design. The need for An increment in the knowledge of health behaviour determinants is consistently pointed out by public health scholars, in particular those with an interest in behaviour change (e.g., Boot & Cairncross, 1993; Dearden *et al.*, 2002; Halvorson, 2004). A range of factors could be linked to the practice of health related behaviours. Evidence to suggest the importance of these factors is critically reviewed in the sub-sections that follow.

The review critically analyses the likely role of 4 factors, namely personal motivations, women's autonomy, household wealth, and women's education, which have been suggested to predict other more extensively documented behaviours influencing child health, such as treatment-seeking, nutrition provision, and reproductive behaviours. Additionally, the review looks at the role of access to EH products in facilitating HHEH.

The sources of literature for this exercise were published papers that analysed the role of either one of the above variables on HHEH behaviour outcomes, or other outcomes relevant to child survival (e.g., children's health status, preventive and treatment-seeking behaviours around children).

3.2 Factors likely to be associated with HHEH practices

3.2.1 Personal motivations

Personal motivations have been referred to as the purposes that the behaviour serves for the people concerned (Boot & Cairncross, 1993). Therefore investigations of personal motivations can mostly be achieved through qualitative methodologies rooted in the interpretative theoretical tradition, which by understanding the problem from the point of view of those affected by it, more capably surface relationships between the behaviours in question and the purposes they serve (Green & Thorogood, 2004). However, it is not expected that people are always able to give conscious thought to their reasons for engaging in certain behaviours. On the other hand, such studies can capture reasons other than motivations, which do not fit with the idea of motivation being a purpose. In fact the respondent may not be aware of any purpose for that particular behaviour, therefore failing to reveal their “motivation”. Other authors refer to “motivations” as “drives” (e.g., Curtis, 2001; Jenkins & Curtis, 2005; Scott *et al.*, 2002), which generally also include aspects other than “purposes”. It is in this broader sense that motivations are looked upon in this context.

In the arena of investigation on factors influencing the uptake of hygiene, sanitation and mosquito deterrence behaviours, a large number of studies focus on personal motivations. In Benin, prestige, modernity, convenience, and privacy were identified as motivators of latrine adoption (e.g., Jenkins & Curtis, 2005). Similarly hand-washing was motivated by achievement of prestige and acceptance within society in Kerala (Scott *et al.*, 2003). Cosmetics and aesthetics were reasons underlying hand-washing in Botswana (Kaltenthaler & Drasar, 1996b), and Peru (Fukumoto *et al.*, 1989), as well as removal of discomfort (Fukumoto *et al.*, 1989; Scott *et al.*, 2003) and physical dirt (Curtis *et al.*, 2003; Kaltenthaler & Drasar, 1996b; Rauyajin *et al.*, 1994). Mother’s nurturing instincts were suggested to drive hand-washing before handling babies in Kerala (Scott

et al., 2003). Curtis *et al* used the same idea to explain why women were more likely to react aversively to stimuli evoking disgust, compared to men (Curtis *et al.*, 2004). Therefore the need to safeguard children emerges as a possible motivation for HHEH protective behaviours.

Regarding mosquito deterrence, as described by Curtis (1989), *Anopheles* mosquitoes, just like any other biting insect, bring nuisance. Therefore nuisance reduction can be a motivation for people to take precautions against mosquitoes in the house. In fact this has been the most widely reported motivation for mosquito deterrence practices (Aikins *et al.*, 1994; Gyapong *et al.*, 1996). Besides nuisance reduction, privacy, warmth, protection from falling debris and other insects were found to be motivations to use bednets (Aikins *et al.*, 1994; Okrah *et al.*, 2002). Privacy was an important motivator in bedrooms with multiple occupiers within polygamous households (Aikins *et al.*, 1994). With particular attention to ITNs, protection from malaria is also considered to be amongst the top motivators for acquisition and use (The Netmark Project, 2001; Zimicki, 1997). However, it is generally reported that this motivation is given less conscious thought compared to the other motivations (Zimicki, 1997).

Perceived economic constraints are also recurrent in the literature on factors influencing acquisition or use of mosquito deterrence products. In a study of 5 West African countries, cost was the major impediment for bednet use (Aikins *et al.*, 1994). The same factor was qualitatively demonstrated to be the most important impeding bednet possession in rural Burkina Faso (Okrah *et al.*, 2002). Money can be a facilitator of the practice, rather than a motivator *per se*, as discussed in section 3. 2. 3 . It can be argued that within the context of personal motivators or drivers for behaviour change the extent of money availability can strengthen or weaken the power of existing personal motivators.

Alongside personal motivators, cultural norms and social expectations are recurrent in the HHEH literature, especially in terms of explaining hygiene.

Whilst cultural studies on diarrhoeal disease and malaria have tended in the past to focus on those cultural norms, which, from the public health

viewpoint, can lead to negative behaviours, there are many social pressures and expectations, which have also the potential to change behaviour towards protective practices. For example, it was found that head of households' desire for latrines in rural Benin was in line with their aspiration to achieve ideal, socially constructed, states of self respect, social class, and completeness (Jenkins & Curtis, 2005). In this way latrine owners could identify with the urban elite and the royals (Jenkins & Curtis, 2005).

Further, by changing norms and beliefs in whole communities, Waterkyn (2005) considers that community members can increase and sustain their demand for sanitation and hygiene in conformity with a newly incorporated "hygiene culture" within their own set of norms, often responding to peer pressure. Particularly sanitation practices have been noticed to serve as outward expressions of conformity with community values. For example, in Zimbabwe, when new sanitary values were introduced to communities, even those unable to afford latrines started hanging their hoes in the yard within visibility of passers by, in order to display their abandonment of the old open defecation habits which were no longer part of the community norms (Waterkyn & Cairncross, 2005).

Besides just looking at the presence and nature of relevant social norms affecting the behaviours in question, it is of interest to identify those individuals likely to comply with such norms and pressures and to understand the extent to which they are motivated to comply. Aspects of this question have been addressed in association with washing children's hands (Dearden *et al.*, 2002). Non-hand-washers were less likely to have received any kind pressure or advice on childcare, while doers were receiving advice from the child's grandparents, who lived in close proximity to them. Besides receiving advice, hand-washers reported having family support on childcare matters, although the type of support given was not specified. Therefore it is possible that these caretakers would have not conformed to such caretaking norms had they not been under the scrutiny of a network of influential people to reinforce those norms upon them.

The above scenario introduces the meaning of family and social networks and norms in shaping HHEH practices. As has been argued that economic situation can shape motivations, such social norms can also enhance or diminish the power of existing personal motivators. Therefore interventions into social networks should be able to mobilise normative pressures against high-risk behaviour and reduce risk behaviours (Friedman & Aral, 2001), in line with the approach to behaviour change held by Waterkyn (Waterkyn & Cairncross, 2005).

Other factors, discussed in subsequent sub-sections to this, namely, education, and economic status can also play a role in patterning the departure from or inclination to conforming to social norms that constrict or facilitate the pursuit of protective HHEH practices.

While extremely relevant to the understanding of current behaviours, explanations regarding other drivers for behaviour can be masked by accounts of personal reasons or motivations. This often happens in malaria-related knowledge attitudes and practice surveys, which invariably hit upon economic reasons as the main drivers or hinderers of adoptions of preventive behaviours. Therefore there is still a need to combine methods from the interpretative tradition with methods that are not limited to relying only on respondents' accounts of their own behaviours. Detailed studies based on observation and enquiry of relevant social background information to explain EH practices are equally important, but less common.

3. 2. 2 Autonomy and other role-based characteristics of women

Although a clear-cut classification for these characteristics has not been found in the literature, there are defining features that comprise interactions between psychological traits of individuals and aspects of the social environment in which they live, which in turn seem to explain certain inequalities in health. Such features, which certain authors call psychosocial factors, include level of hopelessness (Lynch *et al.*, 1997; Macleod & Smith, 2003), independence, self efficacy (Bandura, 1989), hostility, and job control

(Macleod & Smith, 2003), as well as one's sense of control and overall satisfaction with life (Macinko *et al.*, 2004). The presence or absence of these factors was said to cluster with levels of social disadvantage (Macleod & Smith, 2003).

Emancipation is a much talked-about attribute, the absence of which is also a reflection of social disadvantage. Women have by default been a socially disadvantaged group in many societies. For example, in Mozambique a woman's identity is built by mechanisms of socialisation that exclude her from functions of control (UNDP, 2002). Within societies, communities, or households, women are considered emancipated when they enjoy the same rights and opportunities as men and are free from gender-related legal or social restrictions. Therefore emancipation of women goes hand in hand with gender equalities. When investigators have engaged in making the concept of emancipation or gender equality operational, autonomy emerged as a crucial dimension of such a concept, which in turn was suggested to be measurable through decision-making power and mobility (Hakim *et al.*, 2003).

Autonomy can be acquired by different processes, which are not necessarily mutually exclusive, such as education, capacity to independently gain income from outside the home, and maturity.

a) Women's autonomy and health-related outcomes

Women's autonomy has been explored in association with a number of health-related outcomes, especially birth control use and fertility (Hakim *et al.*, 2003). In fact, these demographic and health variables are commonly used proxy measures of women's level of decision-making power within the home, since an increment in such power is thought to be accompanied by a decreased parity (UNDP, 2002). Associations were found in Pakistan between contraception use and both decision-making power and mobility, in the expected direction, even after adjusting for confounders (Hakim *et al.*, 2003). Nonetheless the authors recognised that, although significant, the magnitude of such effects was not remarkably large.

In addition to reproductive health, decision-making power has also been studied in relation to child health outcomes. The focus on women is important in the field of child health because the direct responsibility for children's welfare generally falls on their mothers (Baden, 1997; IIASA, 2001; INSTRAW, 1991). Women's access to independent sources of income, and bargaining position within the household are characteristics suggested to influence responses to children's illnesses, often interacting with wealth, physical access to health services, and perception of illness causation and severity (Molyneux *et al.*, 2002).

In a case-control study, Pfeifer (2001) investigated the relationship between children's nutrition status in Mozambique and women's financial autonomy. This measure of autonomy was chosen on the grounds that independent income outside the home raises the visibility of women's contribution hence increasing recognition of her importance by other householders (Pfeiffer *et al.*, 2001). This can increase her power to negotiate in the home, for example towards better nutrition for the children. The data did not support the hypothesis that mothers of better-nourished children would demonstrate greater decision-making influence on household expenditures than mothers of undernourished children. Mother's proportion of household income was the only proxy for autonomy, making the measurement not a robust indicator of autonomy, as other potential dimensions of this attribute were not captured. In contrast, an analysis of Indian demographic data (Sallee, 2001) revealed a significant association between increased children's height-for-age and increased mothers' power, which was measured by different dimensions besides financial autonomy.

Family structures were strongly suggested to shape women's level of autonomy in Pakistan, where women living in nuclear families (i.e., with their husbands and children only) were more likely to be involved in the decision-making process regarding child treatment and food purchases, compared to those living in non-nuclear families (Hakim *et al.*, 2003). These authors expressed the need for more attention to be paid in future studies to husband-

wife relationships, intra-household distribution of resources, and inter-household linkages including women's links with natal kin (Hakim *et al.*, 2003). This offers reasons to believe that addressing such knowledge gap can be useful to any study looking at the role of women's autonomy.

It has been suggested that in Sub-Saharan Africa, the older the woman, the greater her power, relative to her husband (Ware, 1984). Intra-household support and autonomy was investigated in Mali by comparing the roles of 4 categories of female position within households, namely lone daughter-in-law, one of several daughters-in-law, head wife with daughter(s)-in-law, and sole woman of reproductive age in her household. Lone daughters-in-law as well as women living in their natal families were the least likely to take initiative to seek treatment for their children when ill (Castle, 1993). In agreement, in Kenya, young married mothers were found to have little to say with regards to health care decisions compared to their more mature counterparts (Molyneux *et al.*, 2002). In line with Castle's and Ware's theses (Castle, 1993; Ware, 1984), this submissive role could be reflecting the not yet accomplished marital and reproductive maturity. These results indicated that women's level of authority within the household evolve along with their maturity, and the course of marital and reproductive careers (Castle, 1993).

In Pakistan, a qualitative study revealed that social isolation of a mother would become obvious if her child experienced a diarrhoea episode when the father was physically absent. This was because mothers did not have their own money to meet treatment costs and were not encouraged to request money from in-laws, brothers or own fathers (Halvorson, 2004). This indicates that financial restrictions and within household power relations interact to shape women's ability to take independent action on health matters.

In the case of birth control, it was shown in Pakistan that decision-making power, which reflected how central a woman's role is within the household, showed a strong correlation with contraception use (Hakim *et al.*, 2003). From the same study it emerged that women's high mobility reflected their relatives' trust in them, implying that highly mobile women could have

more important roles within their households, and ability to take independent action without consultation, compared to less mobile women. Mobility also resulted in exposure to information hence increased awareness of different options available to their own health, in particular increased opportunities for trying new forms of contraception.

The above studies investigating the role of autonomy on health-related outcomes seem to have assumed that men (or other influential householders) were less interested in health outcomes than the women under investigation, putting these women under pressure to either bargain for their interests to be met, or to consent against their will. However, none directly measured the actions that others in the household prioritised as compared to the women being studied, therefore opening the possibility that in those households where women's level of autonomy was higher, men or in-laws were also more likely to value effective treatment and protective practices, therefore confounding the effect of female autonomy.

b) Can women's autonomy influence HHEH?

It was earlier seen that women placed at better positions to exert influence over general household affairs, those with increased mobility, as well as those in privileged hierarchical positions within their households were more likely to take independent action regarding their children's and their own health (Castle, 1993; Hakim *et al.*, 2003; Halvorson, 2004; Molyneux *et al.*, 2002)

The conceptualisation discussed above could be applied to the context of women managing their household's environment in rural Africa, since in such settings, where gender inequalities are still striking, a great part of domestic chores lie within the responsibility of women (Halvorson, 2004; Katcha & Watts, 2002; White *et al.*, 1972). Those chores include water collection and management, cleanliness of the premises, removal of waste from the living space, acquisition and employment of mosquito avoidance products, to name but a few.

Although HHEH practices might coincide with women's domestic work, it may not necessarily follow that the management of the household health environment is always within women's complete control. For example, they might not be able to have the means to acquire soap at their own will, or to arrange for better access to water for the entire household. In such cases women's level of autonomy can be crucial. How female autonomy influences the management of the household health environment is not fully established through empirical evidence.

Halvorson (2004) qualitatively identified lack of mobility, autonomy and control over financial resources as major constraints to investing in diarrhoea prevention in Pakistan, with emphasis on purchase of soap, acquisition of proper water containers and latrine improvements. This was one of the few studies reporting specific conflicts of interests between women with small children and their mothers-in-law or husbands on EH-related matters. For example, women were more motivated to use latrines rather than to perform open defecation because the faeces from latrines were composted to fertilise the fields, which was an activity resting in the responsibility of women. Even in households without latrines, women tended to defecate in open pits in order to accumulate the faeces that would serve as fertiliser, while men defecated indiscriminately and saw no need to keep the faeces confined, therefore had no motivation to make arrangements for sanitation improvements in their homes (Halvorson, 2004).

Regarding malaria, there has been more focus on gender roles in the management than the prevention of the disease (Sykes *et al.*, 2003). The relevance of household and family organisation and decision-making within the household in determining mosquito avoidance practices in Ghana has been faintly referred to (Agyepong & Manderson, 1999), but with little discussion of the processes involved in the allocation of cash resources for bednet purchasing. In that setting, as soon as a young girl started earning an income, she was expected to buy her own bednet; the same was not expected of men. Women were also responsible for investing in replacements and fixing of torn nets. They

would meet the costs of bednet replacements and maintenance in competition with meeting the costs for treatment seeking costs, through borrowing and savings.

In Benin it was demonstrated that women were more likely than men to buy impregnated bednets. Here women's income, instead of men's, was amongst the principal variables distinguishing user from non-user households (Rashed *et al.*, 1999). Women's participation in communal organisations, an indicator of exposure to the wider world and mobility, was shown to be significantly associated with household use of ITNs in Benin (Rashed *et al.*, 1999).

The observed dynamics in Ghana and Benin give important insights into the relationship between bednet acquisition and maintenance and women's financial autonomy and mobility but not with regards to decision-making power nor to family structures.

Although conceptually possible, the role of women's autonomy in its influence upon HHEH behaviours is yet to be established empirically and quantitatively. Further, more work on women's autonomy in general has been done in Pakistan, Bangladesh and India, where the social structure differs markedly from the African, therefore studies measuring autonomy in Africa need to make adequate adaptations of this concept, if the role of autonomy is to be examined taking into account contextual realities of Africa.

3. 2. 3 Wealth

Macro-level economic variables such as GDP per capita are recognized to be associated with country-level health status indicators (World Bank, 1993). In general, countries with weak economic performances tend to have higher mortality rates. Three countries, namely China, Costa Rica, Sri Lanka, and the Indian state of Kerala constitute major exceptions to this rule, since they have experienced improvements in life expectancy and infant survival figures under generally defined economic constraints (Rosenfield, 1985).

China is now a great potency, but it was whilst having been amongst the poorest countries in the world during the 50's through the 70's that the country achieved remarkable health improvements such as the fall in infant mortality from 200 to 50 per 1000 live births (Hesketh & Zhu, 2004). China and the other 3 afore-mentioned nations seem to have in common an extremely strong historical commitment to health, social welfare orientation towards development, coverage of medical services for all social groups, and strong intersectoral linkages for health. This orientation of the governments towards social welfare can be summarised as redistribution of income. Taking again the example of China, some argue that the improvements were specifically due to the fact that the country was not a democracy, therefore the government had extreme control over its people and managed to put in place drastic but effective measures such as community participation in the elimination of rats, flies and mosquitoes, training of barefoot doctors, and universal access to health care (Hesketh & Zhu, 2004).

Micro-level economic variables, such as those at the household level, which are relevant in this study, are also of importance to health. They have been referred to as economic facilities, defined as the power that households and householders have to use resources for consumption or exchange (e.g., Sen, 1999). The role of such power is intuitively evident, as many health protective behaviours involve consumption or exchange. In many instances, pro-health choices can be constrained by the competing costs of other commodities for household utility (Berman *et al.*, 1994). This implies that while wealth increases the choices available to householders, limited resources restricts them and often explain the resort to poor health behaviours (Boot & Cairncross, 1993).

a) Wealth and health outcomes

It is recognised by health economists (e.g., Blakely *et al.*, 2005) that most of the strong empirical evidence on economic determinants of health outcomes has come from high income countries.

In the Black report (Black, 1980), which investigated health inequalities in Britain, occupation, not only determined by the level of remuneration, but also by the likely working conditions (i.e., whether indoors or outdoors, whether exposed to air pollution, noise, etc.) explained significant differences in health status. People belonging to unskilled occupations had a 2.5 times greater chance of dying before reaching retirement age, compared to their counterparts from the professional class. Differences were maintained after stratification by age groups. However, the differences were more accentuated among children, becoming less evident in their parents. This suggests that the benefits brought about by increments in adults' occupational status are more important to their children than to themselves.

In general the sharpest gradients of mortality rates across classes in the UK were from deaths caused by accidents, poisoning, violence and infectious diseases, compared to deaths due to cancer and congenital anomalies. Amongst adults, the sharpest differences across occupational classes were due to diseases of the respiratory and genito-urinary tracts, and for males, accidents, poisoning and violence. If differences in mortality rates were solely due to the differential level of access to health services, then morbidity rates would not have varied much across classes. On the contrary, non-professional classes had higher morbidity rates than the professional class, suggesting that economic status was a determinant of health status through prevention of infections and accidents (Black, 1980).

Finally, not only it is agreed that health is primarily determined by the available resources, but also that good health contributes to one's escape from poverty (Blakely *et al.*, 2005). For example, it is estimated that malaria has slowed down Africa's economic growth by 1.3% per year (Bartram *et al.*, 2005). At the household level, however, and despite the fact that the total cost of illness could amount to 10% of the monthly household income, in a review of studies that had measured the economic costs of illness in developing countries, no clear evidence was found supporting the links between malaria in adults and income loss, asset depletion, or lowered consumption levels, mainly

because a range of strategies were often put in place to mitigate the burden of the costs of malaria on the household budget (e.g., intra-household labour substitution) (Russell, 2004). In contrast, the relationship between malaria and income depletion was true for acute, mild or moderate illness in young children. There were other health problems, namely TB and AIDS where this relationship was more obvious due to the fact that those are long-term and more debilitating than one-off episodes of malaria in adults (Russell, 2004). That study did not take into account possible differentials in the impact of malaria on income depletion, stratified by SES.

b) Wealth and engagement in treatment seeking behaviours and health service use

Contradicting Black's finding that wealth advantages are more likely to be brought about through prevention than cure, strong evidence exists, based on analysis of data from 19 developed countries, to suggest that the magnitude of economic inequalities in health can be reduced by improving aspects of healthcare systems, especially in terms of financing (Macinko *et al.*, 2004).

Indeed, explanations of the major links between diminished economic power and poor health are often attributed to the fact that poverty and deprivation underlies underused medical services (Russell, 2004; Ware, 1984), especially in countries where people are faced with unaffordable user fees and bribery. In such settings, poorer households might avoid health service use, which would otherwise result in economic depletion to households whose members would have to resort to pawning of valuable goods, borrowing and temporary cuts in other spending, amongst other strategies (Russell, 2004), which is likely to be more financially damaging for the poor than for the richer households.

Moreover, the poorest are considered to have the weakest social networks of support (i.e., they are less likely to be acquainted with powerful, influential people or institutions) and are therefore excluded from community support systems that may assist households in finding ways around problems

with costs of illness. The above problem has been investigated in relation to healthcare expenditure in Africa (Russell, 1996). Russell's review showed that in many parts of sub-Saharan Africa (e.g., Zambia, Sierra Leone, Nigeria), included in the most important ways of coping with healthcare costs were: borrowing from kin or acquaintances, and relying on money exchange networks (Russell, 1996), which were strategies more likely to be suitable to regular earners. Farmers and labourers were more likely to delay their payments due to the seasonal or irregular nature of their wages which only certain healthcare providers, such as traditional healers, accepted (Russell, 1996). This finding has helped to understand why, despite being as costly as modern healthcare, traditional care is favoured by less wealthy families compared to their wealthy counterparts.

There have been additional sides of household wealth shown to be important determinants of ability to use health care services in settings where people must pay for services. Such ability was said to be dictated in part by intra-household resource allocation decisions. Therefore, certain households can be classified as able to afford health care, but in reality this is not true to all householders (Russell, 1996). This can be due to certain more powerful householders (e.g., male heads of households) prioritising non-essential goods such as alcohol over healthcare expenses (Russell, 1996). Also, often the people with no voice in the household (e.g., non-earners) are more likely not to receive the healthcare they need at all times (Halvorson, 2004; Russell, 1996), which brings back to surface the importance of understanding the already discussed bargaining processes within the households to allocate resources for health and childcare (e.g., Pfeiffer *et al.*, 2001).

Despite the fact that improvements in affordability of curative healthcare can have impacts on health outcomes, such improvements cannot have impacts on preventive measures not dependent on healthcare services use, as shown by Black's data (1980). Household access to other health-related commodities such as nutritious food, water, and sanitation can be impaired by low economic power. Strong associations were found in a cross-country analysis of the

relationship between absolute income poverty (less than US\$1/day) and increasing child malnutrition, and access to unsafe water and sanitation. A study in Mozambique revealed that small differences in household income were accompanied by visible differences in access to water and livestock ownership (Pfeiffer *et al.*, 2001). The latter was assumed, but not empirically proven, to be linked to improved dietary quality through greater consumption of animal protein (Pfeiffer *et al.*, 2001). Such observations implied that even in such apparently economically homogenous communities, a small difference in cash income has potential to impact on quality of life in general.

c) Can household wealth influence HHEH?

Household-level wealth is amongst the most widely found factors in the literature on health-related behaviours. There are however a few examples of studies addressing economic factors in their relationship with preventive behaviours, including those related to hygiene, sanitation, and mosquito deterrence. In studying such relationships there are those that look merely at ownership of and/or access to products and services (e.g., latrines, water supply, soap, and bednets) that result in favourable HHEH conditions, and those that look at the quantity and quality of behaviours that require the use of such products and services (e.g., stool disposal, hand-washing, use of bednets).

The relationship between wealth and ownership of HHEH facilities can be more perceptible than that between wealth and behaviour. Indeed it has been argued that sanitary conditions (as opposed to disease exposure-related behaviours such as hand-washing or safe stool disposal) are the most likely to be conditioned directly by wealth, without interactions with other social variables, such as education, on health production (Bicego & Boerma, 1993). The direct relationship between wealth and actual HHEH behaviours can be less straightforward. To the knowledge of the author, the number of published studies investigating that relationship is narrow, as can be shown in Table 3-1 and Table 3-2.

Mixed results were found in relation to the association between wealth and hygiene and sanitation practices (Table 3-1). With regards to hand-washing, a relationship between radio ownership and thoroughness of hand-washing after defecation was not evident in Bangladesh (Hoque & Islam, 1995), and no correlation between wealth and hand-washing was found in Peru (Gilman *et al.*, 1993). It should be noted that Hoque and Islam (1995) did not analyse differences between hand-washers and non hand-washers, but differences in hand-washing techniques amongst hand-washers, therefore a comparison between the two studies is not fair. However scant, evidence so far points to no indication for an association between hand-washing and wealth.

Regarding sanitation, while father's or head of household's occupation showed significant correlations with reported safe disposal of children's stools in Burkina Faso (Curtis *et al.*, 1995), and observed latrine possession and cleanliness in East Africa (Tumwine *et al.*, 2003), the same variable did not correlate with grounds being visibly free from stools in Burkinabo yards (Curtis *et al.*, 1995). Mother's occupation was not associated with mode of child stool disposal in the same setting (Curtis *et al.*, 1995). There is some evidence to suggest an association between one aspect of wealth and sanitation practices in that the 2 studies investigating this question were in agreement that father's occupation predicts safe disposal of stools (Curtis *et al.*, 1995; Tumwine *et al.*, 2003), even though Curtis' results (1995) relied on reported behaviour.

When hygiene and sanitation practices were measured in terms of indexes, household income and maternal occupation seemed to predict the outcome, but the association was lost after controlling for other variables. The only wealth variables that remained associated with hygiene index were type of housing and asset score (Armar-Klemesu *et al.*, 2000).

Single asset items as wealth indicators have proven inconsistent predictors of hygiene and sanitation practices. Out of the 4 studies that used radio ownership as a wealth indicator (Armar-Klemesu *et al.*, 2000; Curtis *et al.*, 1995; Gorter *et al.*, 1998; Hoque & Islam, 1995), 1 showed that radio was a predictor of reported stool disposal practices (Curtis *et al.*, 1995), and another

suggested that radio was an important effect modifier which enhanced the association between education and overall hygiene scores. Other single items used were ownership of TV and land. The former showed no correlation with hygiene and sanitation practices (Curtis *et al.*, 1995) and the latter predicted hand-washing quality (Hoque & Islam, 1995). On the other hand, not enough studies were found to assess the consistency of findings regarding the relationship between wealth indexes and hygiene. The only study using such a scale found a significant association between that variable and overall hygiene scores (Armar-Klemesu *et al.*, 2000).

Differently from hygiene and sanitation practices, the associations found between wealth and mosquito deterrence outcomes were more consistent (Table 3-2). Only one study did not find an association between income and bednet use (Aikins *et al.*, 1993). After controlling for other factors, income and occupation (mostly of the HoH) remained significantly associated with ITN possession in Afghanistan (Howard *et al.*, 2003), and bednet possession in Uganda (Nuwaha, 2001). In Malawi, a significant association between income and use of any mosquito deterrence product was found, as well as use of purchased mosquito deterrence products, but this analysis did not control for other factors (Ziba *et al.*, 1994).

When single assets were used as wealth indicators, mixed results were obtained. While bicycle ownership was not associated with bednet use in 2 studies in the Gambia, radio ownership was associated with bednet use in the same studies (Aikins *et al.*, 1993; D'Alessandro *et al.*, 1994). One of those studies did not control the finding for other wealth variables, decreasing the strength of the evidence. The balance for this evidence weakened further when it was found in Uganda that radio was not a predictor of bednet use (Nuwaha, 2001). On the other hand, the 4 studies that used a wealth index showed positive correlation with the outcomes of interest, namely use of multiple mosquito deterrence products and bednet use by all householders (Macintyre *et al.*, 2002), bednet possession (Dgedge, 2000; Howard *et al.*, 2003), and bednet use by children under 5 (Clarke *et al.*, 2001).

The relationship between wealth, access to technology and eventual behaviour change may not be as linearly causal as has been conceptualised. For instance, besides being associated with the lack of hygiene and sanitation facilities, low economic status is often associated with poor housing and overcrowding which in turn, as suggested by Boot and Cairncross (1993), are conditions that make the maintenance of good hygiene standards difficult. In this case poverty might be playing a role, not solely by hindering access to hygiene products but also through other practical constraints that it poses such as lack of time to pursue hygiene behaviours.

Ownership of a technology or products has in itself been used as an economic status marker (e.g., presence of water sources or latrines) (Curtis *et al.*, 1995; Strina *et al.*, 2003). The use of such markers as potential predictors of HHEH behaviours might contribute to overestimation or redundancy in the predicting influence of wealth on behaviour. Also to do with overestimation of the effect of wealth, is the choice of radio ownership as yet another asset to indicate economic status. Part of the evidence points towards its association with hygiene practices and bednet possession (Aikins *et al.*, 1993; Curtis *et al.*, 1995; D'Alessandro *et al.*, 1994; Gorter *et al.*, 1998; Hoque & Islam, 1995). However, radio ownership reveals more than just economic power. In the case of bednets the possibility of the link between promotion of bednets through radio messages and increased likelihood of bednet acquisition was raised (Aikins *et al.*, 1993).

Particularly in the arena of mosquito deterrence, often there is the assumption that behaviours are mainly determined by the constraints related to unavailability of financial resources (e.g., Aikins *et al.*, 1993; Okrah *et al.*, 2002; The Netmark Project, 2001). Certainly this type of assumption has prevented investigators from being more critical about their findings on associations between economic status and the use of purchased mosquito deterrents. The extent to which the behaviours are a reflection of the expectations of self and others towards wealthier people is not discussed much in the literature, but a parallel argument to that suggested by Lindenbaum (1989), when elucidating

the links between education and hygiene and sanitation behaviours, could be applied (section 3. 2. 4 .h).

Because HHEH products differ among each other in terms of costs, it is worth discussing the extent to which the relevance of wealth in predicting availability of HHEH products is equivalent to the amount of money needed at one time rather than the total expenditure over time. For instance, while a latrine or a bednet might require a large initial outlay, maintenance costs can be considered occasional and intervals between replacements can span over long periods of time. They can be considered fixed assets. In contrast, while soap, mosquito coils and aerosol sprays can be perceived as cheaper, their regular use translates into recurrent costs which on the long run may end up costing more than the above fixed assets. This discussion highlights the importance of taking into account regularity of income in predicting sustainable HHEH practice.

Table 3-1: Evidence for links between wealth and hygiene and sanitation practices in different settings

Reference	Setting	Study details	Exposure groups	Outcome variable	Results	Comments on quality
Gilman <i>et al</i> (1993)	Peru	Observations on 53 households 3 times	<ul style="list-style-type: none"> Housing quality scale Fieldworker's socio-economic evaluation of the families 	Percentage of non-hand-washing events after mother handling faeces	<ul style="list-style-type: none"> No socio-economic characteristics were related to hand-washing behaviour after faecal contact 	<ul style="list-style-type: none"> Repeated measurements (3 visits) Socioeconomic scales not detailed details on observation strategy not available
Curtis <i>et al</i> (1995)	Burkina Faso	Interviews (2793 mothers)	<ul style="list-style-type: none"> Fathers economic activity (salaried/irregular/cultivator) Radio ownership (yes/no) TV ownership Mother's economic activity Water source (own tap/standpipe/private well/public) 	Children's stools destination (latrine/elsewhere)	<ul style="list-style-type: none"> Stools ended in latrine 2x as likely if father was salaried rather than cultivator. Radio possession predicted more use of latrine for child stool's disposal (OR=0.77). HH with own tap threw stools in latrine 5x more often than HH with wells outside. 	<ul style="list-style-type: none"> Results controlled for other socio-economic factors. Relied on reported behaviours only (subject to recall and response biases).
		Spot observations		Human stools on the ground	Stools seen on the ground 2 to 3x as often if water source was well or standpipe rather than own tap.	<ul style="list-style-type: none"> Relied on observation Analysis controlled for effect of other factors
		Structured observations (548 mothers)	Water source (tap in the yard/ well/ source outside)	<ul style="list-style-type: none"> Hand-washing after cleansing child's bottom Washing of soiled nappies 	<ul style="list-style-type: none"> Tap in yard predicted more hw (OR=1.91, 95% CI 1.08-3.37 n=269) Tap in yard predicted more washing of soiled nappies immediately (OR=2.24, 95% CI 0.74-6.85 n=79) 	<ul style="list-style-type: none"> Relied on observation Results not controlled for other socio-economic factors.

Table 3-1 (continued)

Reference	Setting	Study details	Exposure groups	Outcome variable	Results	Comments on quality
Hoque & Islam (1995)	Bangladesh	Observations (90 housewives)	<ul style="list-style-type: none"> Radio owned (yes/no) Agricultural land owned 	Quality of post-defecation hw (good/poor): Scores depended on whether hands rubbed 3 times; both hands were washed; soap used; at least 0.7 litres of water used.	<ul style="list-style-type: none"> 1.04 (95% CI 0.67-1.60) relative rate of good hw technique in HH with radio, over those without 2.25 (95% CI 1.20-4.22) relative rate of good hw technique in HH with agricultural land over those without 	<ul style="list-style-type: none"> Relied on observation Results not controlled for other socio-economic factors. Statistical analysis strategy not clear
Tumwine <i>et al</i> (2003)	Kenya, Uganda and Tanzania	Semi-structured interviews and observations to 1015 HH	HoH occupation (farmer/educated professional/business person)	<ul style="list-style-type: none"> Latrine fouled Latrine possession 	<ul style="list-style-type: none"> HH where head was an educated professional or business man less likely to have fouled latrines ($p < 0.05$) HH where head was farmer most likely not to have a latrine 	<ul style="list-style-type: none"> Relied on observation Clear outcome measurements Results controlled for other socio-economic factors. No account of magnitude of differences.
Gorter <i>et al</i> (1998)	Nicaragua	2 observation rounds in 172 families	Radio ownership (yes/no) and education	<p>“Good hygiene practices” (hands washed before preparing food, or baby’s bottle; kitchen and living floor clean; garbage not present or organised in heaps; child used nappies or underclothes)</p>	<p>The already established association between more schooling and better hygiene behaviour, slightly stronger in the presence of radio</p>	<ul style="list-style-type: none"> Repeated measurements This analysis was actually to detect effect modification of radio in the relationship between education and hygiene behaviours. No clear measurement of magnitude of associations. Key practices, such as HHWS after contact with faeces and safe disposal of children’s stools not included in analysis of hygiene predictors.

Table 3-1 (continued)

Reference	Setting	Study details	Exposure groups	Outcome variable	Results	Comments on quality
Armar-Klemesu (2000)	Ghana	Interviews and spot observations.	<ul style="list-style-type: none"> • Radio ownership (yes/no) • Household income • Housing quality • Asset index • Place of maternal employment (home/market or streets/ factory, office or shop) • Sex of HoH 	Hygiene index (mother and index child clean; diaper clean; compound and house swept; no poultry faeces, stagnant water, human faeces, or unwashed utensils; drinking water covered)	<ul style="list-style-type: none"> • Crude analysis: Hygiene index positively associated with quality of housing, asset index, expenditure quintile, availability of services, greater income, working in shops, factories or offices • Adjusted analysis: quality of housing and asset index were positively associated with hygiene scores; Being female HoH negatively associated with hygiene index scores 	<ul style="list-style-type: none"> - Relied on observation - Results controlled for other socio-economic factors. - Proxies rather than actual behaviours were measured - Use of composite scores

Table 3-1 (continued)

Reference	Setting	Study details	Exposure groups	Outcome variable	Results	Comments on quality
Strina <i>et al</i> (2003)	Brazil	Longitudinal biweekly home visits with structured observations of mother-child pairs	<ul style="list-style-type: none"> • Piped water in the house (yes/no) • Excreta disposal (adequate/not adequate) • Open sewer near by (yes/no) 	Hygiene index (18 positive and 15 negative hygiene behaviours regarding hw and bathing, washing of food and utensils, water treatment, storage and consumption)	<ul style="list-style-type: none"> • Among HH that had adequate excreta disposal, there were 2.2 x more children with positive hygiene scores than negative scores, whereas in HH without there were only 1.2 x more children with positive scores than negative. • Some association (not significant) was seen between presence of piped water in the HH and likelihood of higher number of positive hygiene scores than negative. • No association of hygiene behaviours with the presence of an open sewer nearby. 	<ul style="list-style-type: none"> - Relied on observation measurements - Results not controlled for other socio-economic factors.
			<ul style="list-style-type: none"> • Piped water in the House 	Hygiene index of water-using behaviours only	No significant difference in the distribution of positive vs. negative behaviours between HH with and without piped water	

Table 3-2: Evidence for links between wealth and mosquito deterrence practices in different settings

Reference	Setting	Study details	Exposure groups	Outcome variable	Results	Comments on quality
Aikins et al (1993)	The Gambia	Structured questionnaire administered to 996 adults over 20 yrs.	<ul style="list-style-type: none"> • Average income in wet season • Average income in dry season • Overall annual income • Ownership of social status items (livestock, carved or metal beds, bicycles, radio or cassette players) 	Bednet use	<ul style="list-style-type: none"> • Mean wet season income of users less than non users' (not significant) • Dry season income of users significantly lower than non-users' ($p=0.05$). • Correlation lost significance with further analysis • Annual income of users not different from non-users'. • Radios owned significantly more frequently by owners than by non-owners ($p<0.001$) 	<ul style="list-style-type: none"> - Clear measurements of crude associations between factors and behaviours; - Clear distinction between factors influencing bednet use and reasons for using or not using bednets, which are often mixed-up concepts. - No account of what might be influencing use of other mosquito deterrence products; - Counterintuitive findings not interpreted. - Confusion between net ownership and use. - Further analysis, perhaps controlling for confounding, not specified.
D'Alessandro et al (1994)	The Gambia	Nationwide survey: 360 compounds visited	<ul style="list-style-type: none"> • Type of bed • Radio ownership • Bicycle ownership • Motorcycle ownership • Cart ownership 	Beds with net	<ul style="list-style-type: none"> • Bednet use higher in iron bed owners compared to other types. • Presence of radio indicator of higher use of bednets ($z=2.54$, $p=0.01$). • Bicycle, motorcycle or cart ownership was not related to bednet use. 	<ul style="list-style-type: none"> - No control for other wealth variables - Stratifications by ethnic group

Table 3-2 (continued)

Reference	Setting	Study details	Exposure groups	Outcome variable	Results	Comments on quality
Ziba <i>et al.</i> (1994)	Malawi	Survey questionnaire to 1531 HoH.	Income level (very low/ low/ moderate/ high)	<ul style="list-style-type: none"> Use of any purchased product to deter mosquitoes. Use of naturally available materials to deter mosquitoes 	<ul style="list-style-type: none"> HH with moderate to high incomes were 5x more likely to have ever used purchased product than those with lower incomes (95% CI 4.1-8.6). This did not vary significantly by specific preventive measurement. Very low to low income level was related to use of naturally available products (OR=1.2, 95% CI 1.0-1.7, p=0.04) 	<ul style="list-style-type: none"> Clear definition of independent variables; Clear measurements of associations between factors and behaviours; No clear definition of behaviour outcome (ever used product, within which period of time?). Inclusion of traditional methods in the analysis of factors influencing mosquito deterrence practices. No adjustments made Cut off points of income categories not specified
Aygepong (1999)	Ghana	<ul style="list-style-type: none"> Cross sectional survey Qualitative study 	<ul style="list-style-type: none"> HH Location (rural/urban) Wealth 	<ul style="list-style-type: none"> Bednet ownership Bednet use Use of any form of protection 	<ul style="list-style-type: none"> Bednet ownership higher among rural residents (237/256) than urban (34/213) Rural HH owned more nets per HH than urban In rural HH 56% of owners reported using bednets, in urban only 6%. Poorer HH less likely to be using protection against mosquito bites 	<ul style="list-style-type: none"> Location not amongst the most appropriate measures of wealth No use of statistically powerful tools. No adjustments made

Table 3-2 (continued)

Reference	Setting	Study details	Exposure groups	Outcome variable	Results	Comments on quality
Nuwaha (2001)	Uganda	Survey questionnaire administered to 643 HoH or spouses.	<ul style="list-style-type: none"> • Radio ownership (yes/no) • TV ownership (yes/no) • Type of house (temporary/permanent materials) • Occupation of respondent and spouse 	Bednet possession	<ul style="list-style-type: none"> • Crude analysis: Use of bednets more likely to be reported in HH with radio (OR=2.31, p=0.003), TV (OR=4.04, p<0.001), living in permanent housing (OR=6.24, p<0.001), respondent being skilled/major business professional (OR=2.50, p<0.001), spouse being skilled/major business professional (OR=3.10, p<0.001). • Adjusted analysis: factors favouring bednet possession were ownership of TV (OR=1.61, p=0.03), permanent housing (OR=4.29, p<0.001), respondent being skilled/major business professional (OR=1.78, p=0.004, spouse being skilled/major business professional (OR=1.82, p=0.008). 	<ul style="list-style-type: none"> - Clear definition of explanatory variables and behaviour outcomes; - Clear measurements of associations between factors and behaviours. - Both crude and adjusted correlations determined - No account of what might be influencing use of mosquito deterrence products other than bednets - No question regarding bednet use, only possession.

Table 3-2 (continued)

Reference	Setting	Study details	Exposure groups	Outcome variable	Results	Comments on quality
Clarke (2001)	The Gambia	Part of a cross-sectional prevalence survey (sub-sample of 618 children)	Socio-economic status (Poorest/average/wealthiest)	<ul style="list-style-type: none"> Use of untreated nets Bednet condition 	<ul style="list-style-type: none"> Children's net use increased from 64% to 73%, and 86% with increased SES group ($p < 0.001$) Nets in good condition increased from 50% to 52% to 69% with increased SES group 	<ul style="list-style-type: none"> The relationships established were not the main objective of the study. Analysis was to explain confounding between bednet use and SES in explaining malaria health outcomes. Significance level of association with bednet condition unknown
Macintyre <i>et al</i> (2002)	Kenya	992 HH surveyed (512 in Kisumu - a larger urban centre, and 480 in Malindi - a smaller coast urban centre)	Wealth index (high/medium/low): based on possession of assets	Use of multiple methods (Yes=at least 3 of the methods reported) Bednet use by all HH members.	<p>Kisumu:</p> <ul style="list-style-type: none"> Wealthiest HH more likely than poorest HH to use multiple mosquito avoidance products (OR=2.39 (95%CI 1.21-4.71)) Wealthiest HH more likely than poorest to report all HH members sleeping under net (OR=2.38 95%CI 1.33-4.25) <p>Malindi:</p> <ul style="list-style-type: none"> Wealthiest HH significantly more likely than poorest to have multiple measures (OR=3.79, 95%CI 1.93-7.45) Wealthiest HH 4X as likely as poorest to have reported all HH members sleep under net. 	<ul style="list-style-type: none"> Clear definition of behaviour outcome variables and explanatory variables. Clear data analysis strategy, with clear measurements of associations between factors and behaviours. Associations adjusted for HH planning and drainage, and education. No attempts to investigate factors influencing use of the products other than bednets.

Table 3-2 (continued)

Reference	Setting	Study details	Exposure groups	Outcome variable	Results	Comments on quality
Howard <i>et al</i> (2003)	Afghanistan	Survey involving 414 households	<ul style="list-style-type: none"> • Job other than farming • Land ownership • Possession of cash savings • Wealth index 	Bednet ownership	<ul style="list-style-type: none"> • HoH that owned nets significantly more likely to have a job other than farming, have electricity, fans, wells, pressure cookers, land, and to have cash savings, compared to non-owners • HHers that did not own nets more likely to work as labourers, and have HH items on credit. • Clear trend found in association between net ownership and socio-economic index: net owners 3 times more likely to belong to richest quartile than the 2 lowest quartiles. This likelihood increased to 4.5 when effect of variation between districts was adjusted using logistic model. • For each unit increase in socio-economic status the odds of net ownership increased by 1.7. 	<ul style="list-style-type: none"> - Clear data analysis strategy. - Clear definition of independent and response variables. - Good statistical approach. - Both crude and adjusted correlations determined.

Table 3-2 (continued)

Reference	Setting	Study details	Exposure groups	Outcome variable	Results	Comments on quality
Lukwa et al (1999)	Zimbabwe	Cross-sectional: 226 HoH responded questionnaire (either mother or father)	HoH employment	<ul style="list-style-type: none"> • Use of plants • Multiple methods to avoid mosquitoes 	<p>Plants used by 12% of employed and 13% of unemployed (number of employed people was much smaller than number of unemployed in the sample). Employed people used 7 types of control measures and unemployed used 13.</p> <p>Wealth significantly associated with higher uptake of bednets</p>	<ul style="list-style-type: none"> - Mosquito avoidance mechanisms other than bednets were included in looking for factors influencing their use. - No use of statistically powerful tools. - No adjustments made for other factors
Dgedge (2000)	Mozambique	Survey questionnaire	<ul style="list-style-type: none"> • Type of housing • Possession of valuable goods 	Bednet uptake		<ul style="list-style-type: none"> - No attempts to investigate factors influencing using each of the products other than bednets. - Magnitude of effect not clear - No adjustments made for other factors

3. 2. 4 Women's Education

The argument on which this discussion stands is that education of women is one of the strongest factors associated with child survival (Caldwell, 1979; Cleland & van Ginneken, 1988; Hobcraft, 1993). Caldwell's analysis of data from Nigeria (Caldwell, 1979) was pioneering in providing empirical evidence for this association. Following his strong suggestion, maternal education became a feature in child health research and advocacy (UNICEF, 1989; World Bank, 2001) as an important factor in its own right. The importance of education in the production of health is acknowledged in fields beyond Public Health. For example in Economics (Sen, 1999), education is considered a social opportunity which is thought to facilitate people to engage in a healthy life and avoiding preventable morbidity and premature mortality, which are important factors influencing the effective participation in economic activities.

This section discusses the extent to which education is likely to have a major influence on environmental health practices, learning from the existing debates on mechanisms of influence of education on other contributors to child survival.

a) Education and health outcomes

From Caldwell's investigation it emerged that maternal education was the single most significant determinant of the marked differences found in child mortality in Nigeria. In addition to this evidence, a review of cross-country analyses involving over 40 countries revealed a consistent linear relationship, showing between 7% and 9% declines in child mortality ratios for every unit increment of maternal education (in years) (Cleland & van Ginneken, 1988).

Further empirical evidence came from a comparative study, which included data from several countries in the Americas, North Africa, Sub-Saharan Africa and Asia², indicating that, without controlling for other socio-economic variables, children³ born to women with at least 7 years of education had a decreased odds of death by nearly half of that amongst mothers with 1 to 3 years of education (Hobcraft, 1993). A relationship between child survival and father's education and occupation was also present, although weaker. Controlling for other factors, including geographical region, attenuations were observed in the apparent effects of maternal education, as well as paternal education and occupation. However, maternal education remained the most powerful factor differentiating child survival outcomes (Hobcraft, 1993).

Important exceptions to the relationship between education and child survival were revealed. In most of the Sub-Saharan African countries included in Hobcraft's (1993) analysis, the apparent effect of maternal education was weak, showing some agreement with Cleland and van Ginneken (1988) who had noticed that the association between maternal education and child mortality was less pronounced in Africa compared to other regions. Hobcraft (1993) could only speculate the reasons for this particularity. One of the more palpable reasons to him was the fact that in sub-Saharan Africa, surrogate child care is commonplace, which can obstruct the effect of maternal education to such an extent that children whose mothers have few years of education may face higher risks of mortality compared to children of uneducated mothers, because the latter end up spending more time with their mothers.

The above exception was partially captured in Nigeria (Adetunji, 1995), where the odds of infant mortality decreased with primary education, compared to a baseline of uneducated women, but increased again with secondary education, unless women had white-collar jobs. This meant that

² Hobcraft (1993) analysed data from the Demographic and Health Surveys from Bolivia, Brazil, Colombia, Dominican Republic, Ecuador, Guatemala, Mexico, Peru, Trinidad and Tobago, Egypt, Morocco, Tunisia, Botswana, Burundi, Ghana, Liberia, Senegal, Togo, Uganda, Zimbabwe, Indonesia, Sri Lanka and Thailand.

³ While Caldwell (1979) and Cleland and van Ginneken's analysis (1988) covered children from 0 to 5 years, in this case child mortality was referred to deaths of children up to the age of 2 years.

while primary educated women were employed as traders which still gave them the advantage of spending time with their children, most secondary educated women were likely to take up out-of-home but low-paid jobs, therefore not having enough money to compensate for the risks associated with long periods of separation between mother and infant, on the contrary of their counterparts employed in executive and clerical positions.

The second reason proposed by Hobcraft (1993) was the fact that in sub-Saharan Africa certain health services such as antenatal care, growth monitoring and immunization have the power of reaching and benefiting across different social groups. Therefore, for less privileged children, this might outweigh the advantage of having educated mothers.

An additional analysis of 41 World Fertility Surveys noticed that the education-child mortality association was less evident amongst infants⁴ after controlling for socio-economic factors (Cleland & van Ginneken, 1988). Maternal schooling of 4-6 years was associated with a 20% decline in infant mortality, while it was associated with up to 58% decline in early childhood mortality and even more emphasised (up to 72% decline) in late childhood mortality. Although the possibility of true age-specific effects was considered, there was also the possibility of these differences being partly due to poor data quality from some countries. The authors also admitted the possibility that this trend was reflecting the effect of universal breastfeeding on infant health and survival.

Another analysis of DHS data from 22 developing countries (Sub-Saharan Africa, Northern Africa, Asia, Latin America and the Caribbean), confirmed the weakness of the correlation between level of education and infant survival. After controlling for socio-economic conditions, maternal primary education per se was significantly associated with survival of offspring to the age of 1 year in only 7 of the countries analysed (Desai & Alva, 1998).

⁴ This study defined infants as children in their 1st year of life (including neonates and post-neonates), whereas early and late childhoods were equivalent to 2 and 3-5 years of life respectively.

Although not discussed in either paper, it should be noted that, especially in developing countries where primary health care systems are working minimally, it is during the first year of life that children, regardless of their socio-economic background, are more likely to receive some sort of health service coverage through growth monitoring and immunization, and this may account for the small infant mortality differentials by mother's education status, as proposed by Hobcraft (1993). Further, as held by Ware (1984), compared to the first 6 months in an infant's life, where breast milk is the key factor in their diets, education differentials in mortality are expected to be more pronounced from 6 months through to the second year of life, when solid food becomes more important. The fact that neonates are included in this age group might also have accounted for the reduced effect of education, as a good deal of neonatal death could be due to adverse pregnancy outcomes or neonatal complications, which are not under the mother's control and depend more on medical technology (Bicego & Boerma, 1993).

Persuasive evidence for the above standpoint came from the Pelotas birth cohort study of some 6000 children (Victora *et al.*, 1992)⁵, which revealed a steady trend of decreasing all-cause mortality, except for malformations, with increased education level. In this study, the association between education level and neonatal survival lost significance when adjusting for confounding. The same effect was attenuated by 50% for infant survival.

These small differences in infant mortality compared to child mortality, in parallel with the small differences found in overall child mortality in most African countries (Cleland & van Ginneken, 1988; Hobcraft, 1993), could bring to the surface the discussion that in instances where health care services are weak, and there are no alternative enhancers of child survival within the reach of their mothers outside the health services, the effect of maternal education on child survival can be attenuated to the disadvantage of all education strata. On

⁵ Longitudinal studies have been argued a better way, compared to retrospective DHS data, of determining the relationships between education and child survival (Bicego and Boerma), and to date there is awareness of very few of them, the other famous one being the study in Cebu, Philippines (Dargent-Molina 1991).

the other hand if services offer homogeneous coverage, the effect on maternal education can also be attenuated but this time to the advantage of all education strata.

In terms of morbidity, Feachem (1984) pointed to a number of observational studies suggesting a correlation between lack of literacy and increased diarrhoea rates, highlighting a study in Bangladesh that revealed that families with no education experienced a 1.7 fold higher incidence of diarrhoea than families with at least one resident who completed high school (Levine *et al.*, 1976). Feachem (1984) criticised this type of study because most did not take confounding by socio-economic factors into account, since diarrhoeal disease can be promoted by factors other than education also linked to education.

Still regarding the link between education and morbidity, few longitudinal studies (which can establish causal relationships with better confidence than one-off observational studies) are documented. The Cebu cohort in the Philippines (Dargent-Molina *et al.*, 1994) showed an inverse, statistically significant, association between maternal education and multiple diarrhoea episodes in infants between 6 and 12 months. The risk of diarrhoea was 25% lower at high education levels compared to low education levels⁶. However, they detected important interaction effects between education and household- and community-level variables in opposite directions. Firstly, the protective effect of education was stronger in better-off communities (mostly urban). This was attributed to unequal access to services such as water and sanitation, and high population densities, in urban areas, making offspring of uneducated women more vulnerable to disease. Further, decline in breastfeeding can be much more harmful to offspring of uneducated women in urban areas, due to their vulnerabilities (poor quality of nutrition, hygiene, and sanitation). Secondly, the protective effect of education was weaker among wealthier households. The interpretation was that household assets compensated for the disadvantages that would otherwise had been brought by

⁶ Completed secondary education was considered high level of education, while low level comprised less than primary and less than secondary education.

lack of education, because such assets allowed mothers to have access to community water and sanitation services.

Although strong evidence exists to suggest that raising the educational status of women can substantially reduce child mortality and morbidity (e.g., Caldwell, 1979; Cleland & van Ginneken, 1988; Hobcraft, 1993), the mechanisms of this relationship are not confidently established. In general, studies investigating factors associated with mortality, disease, or behaviour outcomes around child health include parental education as an explanatory variable, but fail to engage in an in-depth understanding of the quantitatively established correlations between education and the outcomes of interest.

How then education confers benefits to child health? According to Mosley and Chen (1984), firstly, education is associated with more effective external health care seeking which improves recovery from disease. Secondly, it assures better nutrition to children and compliance with immunisation, which reduces susceptibility to disease. Thirdly, it is linked to improved domestic childcare practices, which confer better protection against infection.

A study in Bangladesh has uniquely contributed to the scant anthropological literature on education as a social determinant of child survival (Lindenbaum *et al.*, 1989). The rest of the literature is based on post-hoc speculations from reviews of large demographic surveys. However limited, in this literature, three main suggested pathways feature, namely: (i) women's education brings about changes in aspects of reproductive behaviour such as delay in marriage, wider child spacing, and reduced parity, bringing advantages to their offspring (Barrett & Browne, 1996); (ii) better education means more money allowing better access to child survival-related services and technologies (Barrett & Browne, 1996; Mosley & Chen, 1984); (iii) education translates into better knowledge and understanding of health, which is thought by some to lead almost automatically to better health seeking behaviour (Barrett & Browne, 1996); (iv) better education correlates with valuable, partly social, and partly psychological changes in women (Lindenbaum *et al.*, 1989), which bring positive returns to their children's health (Sandiford *et al.*, 1997).

The evidence to support the suggested pathways is discussed below.

b) Education and changes in reproductive behaviours

Changes in reproductive behaviour associated with education include delayed first birth and widening the length of interval between births. Due to their physical immaturity, very young mothers (under 19) are at risk of losing their first-born children (Kabir & Amin, 1993). These mothers are most likely to have engaged in reproductive life during the years that they would otherwise be engaged in schooling. There is also good evidence that children born after short birth intervals have decreased survival chances. The link between short birth intervals and child mortality is thought to operate through nutritional and care taking pathways (Hobcraft *et al.*, 1985; Kabir & Amin, 1993), in at least 2 ways: firstly, these mothers have weak nutritional reserves which impair foetal growth hence causing low birth weights; secondly, the new babies have to compete with other young siblings for household resources and care. Either way, the bearing is most likely to be on the youngest child (Kabir & Amin, 1993), hence decreasing her survival chances.

Regarding the importance of reproductive health behaviours as mechanisms through which education leads to child survival, with few exceptions (Bolivia, Colombia, Mali and Burundi), this proved not to be demonstrable in the study of 17 DHS data sets (Bicego & Boerma, 1993). Although acknowledged as important exceptions because they weakened the power of generalisation in this demonstration, the investigators did not explore the reasons for such exceptions.

In addition, from an analysis that controlled the effect of education for reproduction variables such as maternal age, child birth order, and birth spacing, it has been concluded with confidence that:

“It is clear-cut: the advantage conferred by education has little to do with shifts in reproductive behaviour”. (Cleland & van Ginneken, 1988),

Although these authors recognised that reproductive risk factors operate in favour of those born to mothers with education, their role was very minor, therefore refuting the proposal that change in reproductive behaviour brought about by education (e.g., postponing marriage and first birth, wider birth spacing, and early cessation of childbearing) is a principal mechanism of influence of education on child mortality. Even if it were the case, certain changes in reproductive behaviour would only be able to explain neonatal and post neonatal mortality, which it did for example in Peru where short inter-pregnancy interval was associated with increased mortality risk only in the first year of life (de Meer *et al.*, 1993). However, there is no evidence to attribute such changes in reproductive behaviour to education, and besides, infant mortality has already been established as being least affected by education as an independent factor. In the few instances where neonatal mortality was associated with maternal education the education differentials could only be attributed to education's links to the economic status of the household and the behavioural variables associated with education did very little to explain the education advantage (Bicego & Boerma, 1993).

c) Education and wealth

Women's education may translate into wealth not only because of the increased potential to secure higher income jobs for themselves (Ware, 1984), hence an economic freedom to provide a desired life quality to themselves and their families, but also because educated women generally tend to marry into wealthier families (Cleland & van Ginneken, 1988; Lindenbaum *et al.*, 1989; Ware, 1984), enabling them and their offspring to enjoy a good quality of life anyway.

Another side to the argument of the role of wealth as an intermediate variable in the maternal education-child health relationship suggests that what is important is not so much the level of wealth of the household women end up in (usually measured by head of household's income, total family expenditure, or possession of assets), but the wealth that she has access to.

In a case-control study to determine the influence of women's share of the total household income on child growth in central Mozambique, this relationship was not supported by the data (Pfeiffer *et al.*, 2001). Instead, maternal education was found to be associated with better nutrition status of the offspring, not because it provided the educated caretakers with an increased likelihood to independently earn money to buy high-quality food, but because these women were perhaps more capable of negotiating greater access to their spouses' cash for that purpose, compared to less educated women in similar economic conditions. This conclusion was sound, as the study was able to distinguish between the woman's ability to make the most of resources brought to the household (i.e., bargaining for spouse's income) and the woman's ability to obtain those resources herself, given that no significant difference in level of own income was found between better and less educated mothers.

Further, Pfeifer confirmed through qualitative work with a sub sample of the same of the above households that in general, women spent all of their cash on daily food ingredients and other immediate household needs, and the group of women that claimed to have ever purchased protein-rich foods (meat, poultry, and fresh fish) had to ask their spouses for additional funds to do so. In only 5% of the households consuming protein-rich foods were they purchased using the mother's own income (Pfeiffer *et al.*, 2001). This group of women had an above average income, suggesting that an income threshold was needed in order for women to enjoy their financial autonomy, and that below that threshold a bargaining power, perhaps conferred by education, was crucial to guarantee a good nutrition for their children.

Pfeifer's results (2001) were in line with Cadwell's (1979), which indicated a mortality decline of 17% amongst the offspring of uneducated women when the father was in a white collar job, but a much larger differential when the child had both a father in a white collar job and a mother with secondary education, not necessarily in a white-collar job herself. This finding was pointing to the importance of educated mothers' ability to mobilise the resources already available to her towards the well being of her children.

However it is not distinguished in any of these studies whether it is the ability to negotiate for resources or the way in which resources available in the household are then used that differentiates educated from uneducated women.

In order to ascertain the role of wealth as an intermediary variable explaining the advantages conferred to the offspring of educated women, there are important interactions to take into account, and there seems to be a threshold where the education advantage through improved economic situation of women is visible and unquestionable. Few studies demonstrate where this threshold occurs for the compensation to be visible (e.g., Adetunji, 1995).

As seen with a few examples, although it seems simple to associate education with an automatic economic advantage to women, which enhances the chances of child survival, it has been shown that in most places where this co-linearity was observed, even controlling for wealth, education remains a strong predictor of child survival, meaning that there is more to the explanation of the education-child health relationship than simply attributing it to wealth. When Caldwell showed that maternal education was a stronger determinant of child survival than other economic variables (e.g., paternal occupation), scholars began to depart from the thesis that education was important solely due to its association with wealth. It was later established from a comparative investigation of data from 15 developing countries (7 African, 5 Asian, 2 Latin American and 1 Caribbean)⁷, that economic advantages linked to education accounted for 50% of the net association between maternal education and child mortality (United Nations, 1985). This furthered the need to continue investigating mechanisms through which education was translating into child survival.

The sections that follow discuss other relevant pathways through which education can be linked to child health outcomes.

⁷ This study used data from World Fertility Surveys and involved the following countries: Ghana, Kenya, Lesotho, Liberia, Nigeria, Sierra Leone, Sudan, Indonesia, Nepal, Republic of Korea, Sri Lanka, Thailand, Chile, Peru, and Jamaica.

d) Education and knowledge of disease causation, prevention and treatment

Education is one of many demographic and structural variables suggested to affect individual's health beliefs resulting in altered health behaviour. Some researchers propose that education is accompanied by cognitive changes, whether from directly learning about health through the contents of school curricula, or through enabling a better comprehension of health messages or instructions in adulthood.

According to a review of the then recent evidence concerning the importance of maternal education in child health, amongst the variables showing the most dramatic differentials by mothers' education, was ORS knowledge (Hobcraft, 1993). Among the countries analysed there were contrasting scenarios. On one hand, in Peru only 25% of uneducated mothers had some knowledge of ORS, contrasting with nearly 90% of educated mothers. Wide differences in knowledge were also found between educated and non-educated mothers in Uganda, Mali, Guatemala, Burundi, Ghana and Bolivia. On the other hand there were countries where overall knowledge of ORS was extremely high (e.g., over 90% in Botswana and Zimbabwe), therefore differentials in knowledge of ORS by mother's education were very small.

The link between education and knowledge was studied in more detail in a rural community of Nepal, where it was demonstrated that schooling was a significant predictor of the ability to understand radio advertisements covering health topics (Joshi, 1994). This suggested that prior familiarisation with health related topics, presumably during the schooling period, and also the possibility of a similarity in format between mass media information and that given at school, facilitated the assimilation of new knowledge.

With further investigation, using principal components analysis, the above authors elegantly disaggregated the "literacy skills" component from the "identity with the modern world" component of education. The data showed that while keeping the child clean remained significantly correlated with education when controlled for "literacy skills", it did not remain so when

controlling for "identity". Opposite results were obtained in relation to health services utilisation. The conclusion was that health services utilisation was being influenced by schooling through "literacy skills", whereas the relationship between education and cleanliness was mediated by "identity with the modern world". However, the conclusion regarding differentials in health services utilisation is not convincing, for the measurement of this variable was limited to the judgement, made by a clinician, on mothers' level of assertiveness and communication effectiveness during medical appointments, making the indicator used for treatment seeking behaviour subjective. Further, "communication effectiveness" and "literacy skills" cannot be treated as separate variables as they are intuitively directly related. Therefore testing for an association between the two would most definitely give a positive result.

Although Hobcraft's analysis of data from the Americas, North Africa, Sub-Saharan Africa, and Asia, showed a relationship between education and vaccination compliance, a much better indicator of effective health services utilisation, there was no indication as to whether knowledge about biomedical disease prevention differed across education strata (Hobcraft, 1993). Likewise in Bangladesh, although the results were supportive of the link between women's education and health-seeking behaviours, there was no evidence that education significantly changed the ideas of women about the causes of disease, because educated and uneducated women shared similar beliefs about causes of disease (Lindenbaum *et al.*, 1989).

Regarding the relationship between knowledge and behaviour, a survey of family health in Guatemala, showed that mothers who believed that a particular disease episode was related to hygiene were more likely to see a doctor about that disease, while mothers who believed otherwise (e.g., folk causes of disease) were more likely to see a curer (Goldman *et al.*, 2002). The same study found no association between beliefs related to eating or hot/cold typologies and type of health seeking behaviour, leading to the overall conclusion that beliefs about underlying causes had weak effects on health-

seeking behaviour. Neither maternal nor paternal education explained the differences found in treatment seeking patterns (Goldman *et al.*, 2002).

Part of the argument against acquisition of biomedical knowledge as the main pathway through which education results in better health seeking behaviour is that although education may introduce new biomedical knowledge, this knowledge might not always cause behaviour differences in adulthood, and also if people are engaged in improved health behaviours, biomedical knowledge might not be the only possible explanation. This is based on the fact that less educated people may perform similarly protective behaviours as the more educated but for reasons other than knowledge acquisition by schooling. The same might be true for educated people. This is because on the one hand there are actions that people take in order to prevent disease, under the influence of a set of beliefs about the cause of the disease and the efficacy of the preventive action, and on the other hand there are behaviours that people carry out for other reasons but which happen to be effective at preventing disease.

Indeed there are examples of settings where biomedical knowledge has been bypassed, resulting in people carrying out health producing behaviours, chiefly preventive, without being fully aware of the links to health. For example, knowledge of malaria causation did not predict bednet use in Burundi (Van Bortel *et al.*, 1996), or Afghanistan (Howard *et al.*, 2003). In fact, as argued by Macintyre *et al.* (2002), whole communities, in malaria-endemic countries, were using mosquito-deterrence techniques long before they could comprehend links between malaria and mosquitoes, and they were not carrying out these behaviours to avoid malaria, but to avoid being bitten and disturbed by mosquitoes.

The earlier discussed Hobcraft's analysis of 25 DHS (1993) found that maternal education did not predict the fraction of children with diarrhoea that received ORS. There were low levels of ORS treatment in all levels of education. This was the same analysis that had shown marked differences in ORS knowledge by mother's education in most countries, therefore contributing to

the mounting indications that health related knowledge that educated women might have, does not necessarily translate into equivalent health producing behaviour.

In sum, knowledge associated with education was found to be related to specific health related topics, for example ORS. Even in such cases, there cannot be conclusiveness that more years of education translates into better knowledge and understanding of health, disease, or biomedicine, therefore translating into better health-seeking behaviour. There are other factors, also related with education, such as inclination to modernism, which might increase the likelihood of more educated women to pursuit better health seeking behaviours.

e) Education and women's power

Women's power within the home, as earlier discussed in this chapter, is thought to be a social consequence of education, with the potential to facilitate behaviour change towards better child health and survival. Along similar lines, the shift from external to inner locus of control (Lindenbaum *et al.*, 1989) has also been considered as a beneficial outcome of education for child health. The latter, a measure of the extent to which individuals believe that life's rewards are within their own reach (Rotter, 1966), can be argued as being indicative of one's perseverance, which reflect autonomy and decision making power. These traits increase the likelihood of more effective health-seeking behaviours, including domestic childcare and use of health services (Sandiford *et al.*, 1997). This point surfaced in Caldwell's interpretation of his results that showed that maternal education was important for child survival. He held that education resulted in a shift from fatalistic views on health outcomes towards an increased ability to manipulate the surrounding world, as well as a shift in family power relations giving educated women more power to exert control over health choices (Caldwell, 1979).

That education and female power were linked was further ascertained from a study of Indian data that showed that women's education affected child

health through power, and that power was a better predictor of child health than education (Sallee, 2001), contrary to Pfeifer's (2001) findings that education per se was a better predictor. There might be differences in family power relationships between India and Mozambique, but also it should be noted that the measurements of power differed between the two studies, having the Indian study perhaps captured more dimensions of power compared to the Mozambican.

Nevertheless the decision-making power conferred on better-educated women need not enhance the survival prospects of all children. For example, in parts of the world where gender-related differential treatment of children is practiced, educated mothers do not seem to treat their sons and daughters more equitably, against all the rationale behind the benefits of maternal education for children. Education amongst Punjabi mothers placed them in a better position to take initiative and act upon their choices to achieve the sex balance that they desired (Das Gupta, 1987). However it is not known from these data whether such initiatives were independent of their husbands' will. Likewise, in a Peruvian region it was recorded that infants born to mothers with 6 or more years of education were more likely to die in the perinatal period, compared to children born to women of lower or no level of education, because of what was considered by the authors as infanticide practice. Such practice did not seem to be censured in that community, as the death of a child provided a little guardian angel (*angelito*) for the family (de Meer *et al.*, 1993). This reminds us that as women become bolder and less fatalistic as a result of education (Caldwell, 1979), this may not necessarily translate into biomedically-prescribed health benefits to all their offspring, in other words in some cases the expected effects of education are mitigated by cultural contexts. However, if the situation is looked at from a different perspective, it might be that the apparent harmful behaviour is somehow beneficial. For example, infanticide may be employed as yet another form of increasing birth spacing, resulting in better survival chances for the remaining children.

f) Education attainment and other attributes of women

The possibility that maternal education might be a confounder for the actual relationship between mothers' cognitive abilities (intelligence) and child health outcomes was raised by some authors (Cleland & van Ginneken, 1988; Lindenbaum *et al.*, 1989; Sandiford *et al.*, 1997). Although the discussions on explanations for the link between women's education and child health had been going since the 1970s (Caldwell, 1979), there were no empirical tests for this alternative thesis until recently (Lindenbaum *et al.*, 1989; Sandiford *et al.*, 1997).

Sandiford challenged most theoretical tendencies that were in favour of the effectiveness of education as a health intervention, by testing the hypothesis that the better health and survival endowed to offspring of educated mothers was not due to better schooling *per se* but rather to their mothers' inherent higher levels of intelligence (Sandiford *et al.*, 1997).

Despite there not being empirical evidence to support this stance at the time, Cleland and Van Ginneken (1988) held the possibility that education might be an outcome, and not a determinant, of a girl's built-in aptitude to learn about the outside world. Their argument was that educated women came from already exceptionally progressive families, which besides guaranteeing an education for their daughters, transmitted to them better psychological and social attributes that in turn would eventually contribute to an increment in the chances of their children's survival (Cleland & van Ginneken, 1988).

A big problem with earlier studies on education and child health has been in finding convincing measurements capable of discerning inner cognitive abilities from those acquired through education. Sandiford and colleagues addressed this problem in a cohort study in Nicaragua (Sandiford *et al.*, 1997). The cohort had 3 arms distinguishing women that had had conventional schooling in childhood from those that had attended adult literacy programs only and those that had not had any form of education. In this way they managed to identify women who, if not for the adult literacy program, would have most likely remained illiterate in adulthood. In fact, the socio-economic profiles of newly literate women did not differ from those of uneducated

women, and were significantly lower than those of women with formal education. Therefore, it was possible to separate the fact that women were literate from the fact that they might have been so due to their privileged social and economic background.

The analysis, which controlled for socio-economic variables, indicated that intelligence, which was measured through a test on simultaneous processing ability in problem solving, was an unimportant predictor of child survival amongst literate mothers but a crucial one amongst illiterate ones. They also found that literacy, which was measured through specific reading and writing tests, had a positive effect on child survival for most women except for those with exceptionally high intelligence, meaning that knowledge, attitudes and skills required to ensure child survival could have been acquired either through intelligence or formal education.

Another attribute considered in the interpretation of Sandiford's thesis (Sandiford *et al.*, 1997) was motivational disposition to engage in problem solving exercises, which could have reflected on the ability to engage and succeed in the study's intelligence tests, as well as the ability to both have successfully acquired literacy and successfully kept offspring alive and healthy. However, the study was not successful at confidently separating motivational disposition from cognitive ability.

As Cleland and van Ginneken's argument continues: if the selectivity effect of education is true, it can only be in places where education for girls is a rarity (Cleland & van Ginneken, 1988), therefore challenging the relevance of their own and Sandiford's argument regarding the role of education in settings where education tends to reach universal rates (Cleland & van Ginneken, 1988; Sandiford *et al.*, 1997).

g) Education and engagement in treatment seeking behaviours and health service use

A thorough examination of the links between education and use of health services was provided by Cleland and van Ginneken's review (1988). The

review pointed to empirical evidence from studies in Asian, West African, Arab, and Latin American countries, which persuaded to a conclusive positive correlation between increased maternal education and utilisation of modern maternal and child health services, more so for preventive than for curative service, even after adjusting for other important socio-demographic variables (e.g., maternal age, residence and occupation).

The relationship between maternal education and use of antenatal care was later investigated in an analysis applied to survey data from 17 developing countries. After controlling for economic status, the levels of excess risk of non-use of antenatal clinic were 55 to 1300% among uneducated women compared to women with secondary education (Bicego & Boerma, 1993). These authors did not attempt to suggest the reasons for such wide variations across countries. They further noticed the tendency of such differentials to be more marked in rural than urban areas (Bicego & Boerma, 1993).

In terms of use of curative services, the overall differential use of medical facilities for children experiencing fever, according to mother's education, ranged from 33% differences in Ghana (in the expected direction) to 21% in Togo and Colombia (Hobcraft, 1993). Differentials in the remaining countries lay in between. This was with the exception of Botswana where an overwhelming proportion of women sought treatment at a health facility when their children had fever, regardless of their education status (Hobcraft, 1993).

Similarly, a smaller scale study in Bangladesh revealed that 2/3 of educated women went directly to the hospital for ORS when their children experienced diarrhoea in contrast with nearly 1/2 of uneducated women, who initially had sought other remedies (Lindenbaum *et al.*, 1989). These results were not statistically significant, as the sample size used did not allow for such powerful statistical tests. However, this study collected mostly qualitative data, giving some insights to the complex linkages between education and health-seeking behaviour. For example they suggested either informed choice of medical intervention for diarrhoea by educated women, or inclination of uneducated women to prioritise easy access, less complicated, alternative

medical care before the last resort which was the clinic (Lindenbaum *et al.*, 1989). The data were not supportive of the assumption of informed decision, as all women shared the same beliefs about disease aetiology and cure.

The latter of the above two hypothesis was substantiated by a detailed case study on treatment seeking behaviour, which strongly suggested that educated women gained access to a wider and lasting network of contacts who could provide help as required, especially in instances when treatment seeking implied travel costs, medical expenses, and other complicated endeavours requiring a great deal of support (Lindenbaum *et al.*, 1989). In this particular case study, the likely effect of wealth rather than of education *per se* can be ruled out, as the person being studied was a widow living in poverty with her in-laws. On how education led to this increased social capital, the authors argued that educated women were in the position to command the assistance of other elite members in better circumstances than themselves, who were strategically placed in many stages of the treatment seeking processes they had chosen to pursue (Lindenbaum *et al.*, 1989).

Moreover, they have a better sense of geography of the wider world beyond the compound where they live (Lindenbaum *et al.*, 1989), hence less fear to venture out despite all the obstacles facing them. There is a further argument that even once the problem of barriers to access is solved, educated women may still face an advantage because they can insist on better care either because they can communicate better with health care professionals or because health care professionals give them better consideration (Cleland & van Ginneken, 1988). This is in agreement with the argument that literacy skills provide women with assertiveness in communication with health care professionals (Joshi, 1994). Once receiving medical care they are more likely to retain and process crucial information passed on to them by health professionals, hence more able to adhere to recommended treatment and follow-up (Cleland & van Ginneken, 1988).

Besides treatment seeking at modern health facilities, many studies looked at vaccination compliance to measure health-seeking behaviour in

relation to education. An analysis of 23 DHS surveys (Boerma et al 1990) revealed that, in 20 of the countries, over 90% of women with secondary education had their children vaccinated at least once, whereas children born to uneducated women were far less likely to have received at least one vaccine. Hobcraft's analysis of the same countries (1993) confirmed this, adding that compared to uneducated women, educated women were even more likely to have had their children fully vaccinated. However, it was admitted that it was possible that selection bias towards educated women occurred because only the children possessing vaccination cards were included in the study (vaccination card status is highly correlated with education), and this could have distorted the results (Hobcraft, 1993).

Similar results were reported in a cross-country analysis of DHS data from 22 countries (Desai & Alva, 1998). These authors advised cautious interpretation of the large educational differentials found in the number of immunizations, owing to the same problem of overestimation of the effect of education due to selectivity. In contrast, Cleland and van Ginneken (1988) reported no links between education level and immunization compliance, but they were based on two single studies, in the Philippines and Ghana, and were specifically referring to mass immunisation programs, which inherently manage to attain extensive coverage due to their aggressiveness and outreach nature, and therefore less subject to selectivity than the standard EPI interventions investigated by the other authors (e.g., Hobcraft, 1993).

A small study in the Gambia illustrates another instance where outreach capacity of services supersedes the influence of education on services utilisation. In that setting, children had up-to-date immunisation schedules and used the clinic frequently irrespective of their mothers' education levels (Barrett & Browne, 1996). Confirmation from clinical records enhanced the credibility of this finding, and this homogeneity in health services use was attributed to a well-publicised national immunisation campaign as well as good accessibility to and convenient opening hours of the health services (Barrett & Browne, 1996).

Very few low and middle-income countries have effective and accessible services functioning in such a way even to narrow the child survivorship differences across education strata. One of such few countries is Cuba, where health care services are within reach of the wider population, and differential levels of child mortality by mother's education have become small (Ware, 1984). There is also the strong possibility that services may be minimally effective but not easily accessible, which is what an analysis of DHS data from 17 developing countries revealed (Bicego & Boerma, 1993). The results showed that education advantages through better use of health services are more pronounced in urban than in rural areas, meaning that educated women are more capable of jumping the bureaucratic and other complex obstacles associated with the use of modern services in the urban environment because of their broader social and economic support systems.

The discussion thus far points to education as being strongly correlated with the use of modern health care services, unless such services have a great coverage. Studies have shown that educated mothers are more likely to succeed in gaining access to medical care, as they have more propensity to identify with and respond to novel ideas proposed to them (Cleland & van Ginneken, 1988), such as oral rehydration and inoculations.

An investigation in Nigeria (Caldwell & Caldwell, 1985) suggested an interaction between education and presence of health care services on the grounds that while the mere presence of health services improved child survival by 20%, female education in the absence of health services contributed to a 30% increase in child survival, and finally the joint effect of both variables accounted to an increase in child survival in excess of 80%. This meant that the greatest mortality differential between offspring of educated and uneducated women was due to the presence of health services. This effect was also recorded in a retrospective cohort study in Nicaragua (Sandiford *et al.*, 1997), where educated women suddenly started gaining significant child survival advantage over non educated women only from the mid-1970s onwards, a period when

PHC infrastructure was put in place which started giving educated women some control over the fate of their children.

However, Cleland and van Ginneken (1988) point to other countries, probably the majority of developing countries, where the health systems are so dysfunctional that they cannot bring advantages even to children of educated women, meaning that it is not just a matter of the presence of these services, but the performance, that counts.

Although it has been demonstrated that education can enhance the use of health services, most studies have not been able to demonstrate that it is the increased use of health services by educated mothers that translates into increased child survival rates. Some argue that in order to better establish this relationship, longitudinal studies, rather than analyses based on retrospective DHS surveys, will be needed (Bicego & Boerma, 1993). The same authors argue for more qualitative studies on this subject, on the grounds that it is difficult to attribute the enhanced prospects of child survival to reported health facility visits of unknown character, quality, or consistency, and under unknown circumstances. There is speculation that the particular health services captured by the typical studies addressing the issue under discussion are not known to be the most effective in controlling child mortality (Bicego & Boerma, 1993). Particularly, the immunizations talked about here (polio, measles, BCG, etc.) do not target most current causes of mortality in low-income countries, e.g., malaria, ARI, and diarrhoea. Further, given the special attention given to diarrhoeal diseases in some of these studies, besides the much-documented ORS use, more effective preventive practices to control diarrhoea exist, which do not depend on health services intervention (e.g., sanitation and hygiene behaviours), and this aspect has not been fully explored with regards to its determinants.

As discussed in the section that follows, authors that challenged the idea that most of the maternal education effect on child survival operates through the already demonstrated differential use of health services, also suggest that

care practices at home could explain a great deal of maternal education-related advantages to children under 5.

h) Can education influence HHEH?

Much can be learned from the suggested mechanisms of the association between maternal education and treatment seeking behaviours and applied to the explanation of patterns of HHEH preventive behaviours at home.

As seen thus far, in the literature there are several accounts of treatment seeking behaviours, with regards to how they might be linked to maternal education to explain differential advantages in child survival. Similar reasoning used to explain treatment seeking patterns could be applied to generate the hypothesis that incremental women's education levels increases the likelihood of them following protective hygiene, sanitation, and mosquito deterrence practices.

Compared to treatment seeking behaviours, fewer efforts have been made to study preventive practices other than immunisation compliance as possible mechanisms for the influence of education on child survival. However, as seen in one of the few cohort studies examining the role of maternal education in relation to child health outcomes, the relationship between maternal education and child survival is particularly strong for infectious diseases. While these diseases accounted for over 50% of deaths of offspring of uneducated and less educated women, only 10% of deaths in those born to women with 9 or more years of education were due to infectious diseases (Victora *et al.*, 1992). In this study, which was conducted in Brazil, deaths from ARI and diarrhoea accounted for over 80% of all infectious disease mortality. This offers reason to argue that preventive behaviours to these diseases cannot be ruled out as being highly influenced by women's education. Further, and as earlier mentioned, the household and community-level water, hygiene and sanitation conditions constituted a central part of the discussion and interpretation of the interesting mortality differentials, by education levels, found in the Cebu cohort study (Dargent-Molina *et al.*, 1994).

Studies looking at education as a factor influencing HHEH practices are few and are summarised in Table 3-3 and Table 3-4.

Table 3-3: Evidence for links between education and hygiene and sanitation practices in different settings

Reference	Setting	Study details	Exposure groups	Outcome variable	Results	Comments on quality
Curtis <i>et al</i> (1995)	Burkina Faso	Interviews (2793 mothers)	Maternal education (none/primary/secondary)	Children's stools destination (latrine/elsewhere)	<ul style="list-style-type: none"> • Crude association found ($p < 0.05$). • No correlation after adjustments for socio-economic and demographic variables. 	<ul style="list-style-type: none"> - Analysis controlled for wealth. - Relied on reported behaviours only. - Magnitude of crude correlation not specified.
		Spot observations		Human stools on the ground	No correlation	<ul style="list-style-type: none"> - Direct observation
Hoque & Islam (1995)	Bangladesh	Observations to 90 housewives	Woman's schooling = 3 or more yrs (yes/no)	<ul style="list-style-type: none"> • Quality of post-defecation hw (good/poor): Scores depended on whether hands rubbed 3 times; both hands were washed; soap used; at least 0.7 litres of water used. 	1.64 (95% CI 1.08-2.50) relative rate of appropriate hw technique in more educated, over less educated women	<ul style="list-style-type: none"> - Results not controlled for other wealth. - Unclear analysis strategy - No tests for significance of associations
Barrett & Browne (1996)	The Gambia	Detailed HH survey (with spot observations) targeting 42 mothers of children under 5	Women's education (less than 1 yr/1-6 yrs)	Latrine index (composite score combining usage and cleanliness)	<ul style="list-style-type: none"> • 60% of educated mothers scored highly whereas 40% of uneducated scored less • Result not statistically significant. 	<ul style="list-style-type: none"> - Small sample size. - Composite score

Table 3-3 (continued from page 114)

Reference	Setting	Study details	Exposure groups	Outcome variable	Results	Comments on quality
Gorter <i>et al</i> (1998)	Nicaragua	Observational study (2 observation rounds) in 172 families	Mother's education (3 or less yrs/ more than 3 yrs)	No faeces on latrine slab No human faeces on patio Faeces removed from child's place of defecation	No correlation No correlation • Outcome observed in 100% of mothers with more education, while on 92% of mothers with less education. • Result not significant.	- Clear outcomes defined. - Clear strategy of analysis. - Analysis did not control for wealth on these particular variables.
Armar-Klimesu (2000)	Ghana	Survey (with spot checks) of 556 HH	Maternal education (none/primary & middle/secondary)	Mother's hw after visiting latrine	• Observed in 50% of mothers with more education, while on 0% of mothers with less education. • Result not significant.	- Clear study design and analysis strategy. - Analysis controlled for wealth. - Composite score
Tumwine <i>et al</i> (2003)	Kenya, Tanzania and Uganda	Semi-structured interviews (1015 HH) Observations	HoH education (categories not specified)	Fouled latrines	Significant association ($p < 0.05$): the more educated the mother the less likely they were to fall in the category where 0-3 good practices were observed, and the more likely they were to fall in the category of HH where 6 good practices were observed. HH where head was educated less likely to have fouled latrines ($p = 0.001$), after adjusting for other socio-economic and environmental variables.	- Unclear variable specification - Data collection not detailed. - Results not adjusted for wealth

In general, the studies have had a tendency to detect better hygiene indicators in households with increased education levels (Armar-Klemesu *et al.*, 2000; Barrett & Browne, 1996; Curtis *et al.*, 1995; Gorter *et al.*, 1998; Hoque & Islam, 1995; Tumwine *et al.*, 2003). However, there were cases where marked differences were apparent, but perhaps sample sizes were small to allow the results to bear statistical significance or results were not adjusted for wealth.

In a study in Nicaragua hand-washing following latrine visits was not observed at all amongst uneducated mothers, whereas ½ of the educated mothers in the sample were seen performing it (Gorter *et al.*, 1998). These results were not statistically significant. In Bangladesh, thorough hand-washing was observed more often in the group of women with 3 or more years of education compared to the less educated ones, but results did not take into account possible confounders.

In Nicaragua, while 100% of the educated women were seen safely removing children's faeces from the floor, 92% of the uneducated women were seen doing so and this small difference was not significant (Gorter *et al.*, 1998). The same study found no correlation between maternal education and faecal contamination of latrine and floor. In the Gambia, a 20% difference in latrine usage and cleanliness between educated and uneducated women was not significant (Barrett & Browne, 1996). In Burkina Faso, observed faecal contamination of grounds showed no association with maternal education and the significance of the correlation between education and reported sanitation behaviour was lost after adjustments for other factors (Curtis *et al.*, 1995). This suggests that when education is correlated to certain hygiene behaviours, wealth might explain this correlation partially.

It is difficult to weigh the balance of existing evidence in relation to the influence of education on hygiene because in each study, either singular aspects of hygiene were assessed, that had not been measured elsewhere in the same way and for the same analytical purpose, or behaviours were lumped together in so called "hygiene indexes" again comprising unique combinations of elements of behaviour, thus impairing a fair comparison across studies (Table

3-3). For example, in Ghana a wide range of components, namely personal and child cleanliness, diaper cleanliness, washing of utensils, protection of drinking water, sweeping of yard and indoor space, absence of poultry, human faeces, and stagnant water, contributed to a hygiene variable (Armar-Klemesu *et al.*, 2000). This measurement did not allow the identification of single hygiene behaviours likely to be more influenced by education than others.

One sanitation variable, which was measured in more than one setting, namely Burkina Faso (Curtis *et al.*, 1995) and Nicaragua (Gorter *et al.*, 1998), and showing concordant results, was observation of human stools on the ground. Destination of children's stools was also measured in those 2 studies (Curtis *et al.*, 1995; Gorter *et al.*, 1998). However, while the Burkina Faso study used interviews, the Nicaragua study employed structured observation to measure this outcome, making the comparison between these studies problematic. These studies obtained slightly dissimilar results, which nonetheless were both pointing to no evidence in favour of the correlation between this practice and maternal education (Table 3-3).

In addition to this problem, the operational definition for the variable "education" varied a great deal across studies, both in terms of the persons whose education was measured and the cut off points defining the education strata. For example, the second and last sanitation variable that was measured in more than one study in relation to education was cleanliness of latrine (Gorter *et al.*, 1998; Tumwine *et al.*, 2003), but the comparison between the two studies proves impracticable because they did not measure the education of equivalent actors.

All in all, although a conceivably plausible relationship, there is only weak and inconclusive evidence to support the hypothesis that increment in women's education levels increases the likelihood of them following disease protective hygiene and sanitation practices at household level.

Education as a determinant of mosquito avoidance practices has been looked at in some settings, mostly in Africa (Table 3-4).

Apart from a large study in the Gambia (Aikins *et al.*, 1993), which counter-intuitively showed that respondent's formal education was associated with non use of bednets ($p=0.015$), at first glance the picture seems to be different from what was seen in relation to hygiene and sanitation, given that the results seem more consistent and in favour of a positive association. However, the conclusions in half of these studies relied on crude associations only, not taking into account interactions with wealth in the associations found (Govere *et al.*, 2000; Howard *et al.*, 2003; Ziba *et al.*, 1994). Often no adjustments were made for wealth because, as in most studies on determinants of bednet use, wealth was the main explanatory variable, and education was looked at as one of many other explanatory variables for the initial bivariate analysis, and then used to control for the effect of other demographic variables (e.g., age, marital status, and sex) perhaps of more interest to the authors (e.g., Ziba *et al.*, 1994).

In the 3 studies that did make adjustments for the relationship with education, in 2 cases the correlation was not maintained (Aikins *et al.*, 1993; Nuwaha, 2001), and on the other mixed results were obtained according to area of residence (Macintyre *et al.*, 2002), in that in the larger city more marked education differentials were found for bednet use, and that use of multiple methods of mosquito avoidance was only associated with education in the larger city.

The only study that captured women's education did so by enquiring about the spouse's education in addition to head of household's education (Nuwaha, 2001). Despite the fact that in this study the correlations with education disappeared after adjustments for wealth, the crude correlations between education and bednet possession were stronger when it came to the spouses education indicators compared to the head of household's education.

Similar to what was seen regarding hygiene and sanitation behaviours, it is tricky to reach a conclusion on the basis of balancing the existing evidence for the association between education and mosquito avoidance practices, which range from the mere possession of a bednet to the use of any commercial

mosquito deterrent by any householder and are hence not comparable between most studies (Table 3-4). Nonetheless on the whole the existing evidence is mixed with regards to the role of education in general, but extremely poor with regards to the role of women's education.

Table 3-4: evidence for links between education and mosquito avoidance practices in different settings

Reference	Setting	Study details	Exposure groups	Outcome variable	Results	Comments on quality
Aikins <i>et al</i> (1993)	The Gambia	Structured questionnaire administered to 996 adults over 20 yrs.	Respondent's education (none/some)	Bednet use	<ul style="list-style-type: none"> • Villagers with no education used bednets more frequently than those with koranic or some form of formal education (X^2 for trend=6; $df=2$; $p=0.015$). • Further analysis showed no significant relationship between bednet usage and education. 	<ul style="list-style-type: none"> - Clear definition of independent variables and behaviour outcomes; - Clear measurements of associations between factors and behaviours; - Clear distinction between factors influencing bednet use and reasons for using or not using bednets, which are often mixed up concepts. - Adjustments made for wealth - No account of what might be influencing use of other mosquito deterrent products; - Counterintuitive findings not interpreted. - Further analysis not specified
Ziba <i>et al.</i> (1994)	Malawi	Survey questionnaire to 1531 HoH.	HoH education level (primary or none/secondary or higher)	Use of any Purchased product to deter mosquitoes.	<ul style="list-style-type: none"> • Having used a purchased mosquito deterrent product in HH strongly associated with increased education ($X^2=129$, $p<0.001$). • Respondents with secondary+ education 8x more likely to have used purchased product than those with primary/no education. • Increased use of natural products inversely associated with education (OR = 2.5, $X^2 = 20.5$, $p<0.001$). 	<ul style="list-style-type: none"> - Clear definition of independent variables; - Clear measurements of associations between factors and behaviours; - No clear definition of behaviour outcome (ever used product, within which period of time?). - Inclusion of traditional methods in the analysis of factors influencing mosquito deterrent practices. - No adjustments made for wealth

Table 3-4 (continued)

Reference	Setting	Study details	Exposure groups	Outcome variable	Results	Comments on quality
Govere <i>et al</i> (2000)	South Africa	Structured questionnaire administered to senior female heads (16-85 yrs) of 299 HH	Women's education (categories not specified)	Use of either modern or traditional personal prevention.	Positive association between education level and use of medically recommended malaria prevention measures ($X^2=16.4$, $df=3$, $p=0.001$)	<ul style="list-style-type: none"> - Appropriate statistical tools used to test associations; - No definition of medically recommended methods; - No definition of actor's education. - No inclusion of traditional methods in the analysis of factors influencing mosquito deterrence practices; - No adjustments made for wealth
Nuwaha (2001)	Uganda	Survey questionnaire administered to 643 HoH or spouses.	Respondent's and spouse's education (<11 yrs/ > 11 yrs) Respondent's and spouse's ability to read English (yes/no) Respondent's and spouses ability to read vernacular (yes/no)	Bednet possession	<ul style="list-style-type: none"> • Bednet use favoured respondent/spouse having >11 yrs of education (OR=2.63) • Bednet use favoured ability to read (OR=2.22 & 3.60 respectively). • Correlation did not maintain after adjustments. 	<ul style="list-style-type: none"> - Clear definition of explanatory variables and behaviour outcomes; - Clear measurements of associations between factors and behaviours. - Adjustments made for wealth - No account of what might be influencing use of mosquito deterrence products other than bednets - No investigation of bednet use.

Table 3-4 (continued)

Reference	Setting	Study details	Exposure groups	Outcome variable	Results	Comments on quality
Macintyre <i>et al</i> (2002)	Kenya	992 HH surveyed (512 in Kisumu and 480 in Malindi)	Education level of the most educated person in the HH (low=no education to standard 6/ medium=standard 7 to form 3/ high=form 4 to university)	Use of multiple methods (Yes=at least three of selected methods reported) Bednet use by all HH members.	<ul style="list-style-type: none"> • Kisumu (larger urban centre): Best educated HH were 5x more likely than HH in lowest education categories to use multiple mosquito avoidance products. Best educated HH were 7x as likely as least educated HH to have reported all HHers to sleep under a Bednet. • Malindi (smaller coastal urban centre): HH education not associated with use of multiple products. Best educated HH were 4x as likely as the least educated HH to have reported all HHers to sleep under a Bednet. 	<ul style="list-style-type: none"> - Clear definition of behaviour outcome variables and explanatory variables. - Clear data analysis strategy, with clear measurements of associations between factors and behaviours. - Associations adjusted for HH planning and drainage, and wealth. - No attempts to investigate factors influencing using each of the products other than bednets.
Howard <i>et al</i> (2003)	Afghanistan	Survey involving 414 households	HoH education (none/primary/secondary/ higher)	Bednet ownership	Heads with bednets significantly more likely to be better educated than heads without	<ul style="list-style-type: none"> - Clear data analysis strategy. - Clear definition of independent and response variables. - Clear data analysis strategy. - No adjustments for wealth

Explanations for the links between education and household environmental health practices remain speculative. Some of these pathways feature in a few thorough discussions on the broader category of childcare practices within the domestic context (Cleland & van Ginneken, 1988; Lindenbaum *et al.*, 1989). Those discussions point to four possible ways in which education could have an impact. Firstly, education entails cognitive changes, which can facilitate female caretakers' ability to recognise and avoid behavioural risks to infection. Secondly, attitudinal and social changes, such as improved responsiveness to new ideas, and greater identification with the modern world could be linked to education. Thirdly education is correlated with other social changes such as widening of personal networks, and greater access to resources (both monetary and non-monetary). Finally women's education provides greater autonomy and decision-making power, which in the domestic environment can prove crucial in favour of young children who are under their care. Each of the above possibilities is discussed as follows.

Cognitive changes - Conceptually, education brings about changes in perception of disease causation (that is if education includes learning about disease causation) therefore facilitating preventive action. However, in many cases, knowledge of the disease exists, even if most definitely brought about by education, but practice does not follow as was seen with treatment seeking behaviour (Hobcraft, 1993). A tremendous example to illustrate the not so functional role of knowledge in producing preventive hygiene behaviours is that, prior to an intervention aimed at increasing hand-washing frequency among medical staff of an intensive care unit in Australia, it was found that medical doctors, whom are expected to be aware of the health benefits of hand-washing, only washed their hands at rates of approximately 12% and 11% before and after patient contact respectively (Tibballs, 1996).

It has also been acknowledged that knowledge of diarrhoea transmission is not enough to encourage mothers to manage the household environment hygienically (Boot & Cairncross, 1993). A hygiene education intervention in

Bangladesh illustrated this point, having shown that, following the intervention, significant improvements in knowledge about diarrhoeal disease transmission as well as the benefits of hand-washing and latrine use had no significant impact on hygiene behaviours (Hoque *et al.*, 2002).

In addition, Dominican Republic mothers participating in a KAP study showed a level of understanding of the link between hand-washing and disease prevention, as they reported getting rid of contamination with germs as a reason to wash their children's hands (McLennan, 2000). However, it was interesting that there was no significant difference in the level of knowledge between mothers that reported engaging in hand-washing behaviours and those who did not, meaning that knowledge was not a strong hand-washing motivator. However, the authors were not able to conclude that basic biomedical knowledge about diarrhoea prevention was not essential for those few mothers engaging in preventive practices. But given the high levels of germ theory knowledge in the sample and low hand-washing rates, the results were showing that basic knowledge of germ theory was not sufficient to engage a large percentage of a community in preventive behaviours.

Among lay communities, however, studies have assessed health-related knowledge or beliefs at a superficial level, not taking into account the depth of conviction held by the respondents. For example, in the Dominican Republic study (McLennan, 2000), it could be that although the majority of caregivers could easily recite what they knew in terms of the relationship between hand-washing and disease prevention, very few really believed what they said.

The examples given indicate that education may lead to better understanding of HHEH behaviours but not necessarily lead to behaviour change in this way.

Attitudinal and social changes - While it is debatable that education imparts sufficient knowledge to guarantee health behaviour changes, there is a school of thought holding that there are social and attitudinal changes associated with education, which might lead to behaviour change by better-educated women.

As put by Caldwell (1979), the authority of the school can challenge certain traditional values, therefore education not only changes the attitudes of the educated people but also the attitudes of others in their society towards them. Therefore educated people are "allowed" to behave differently. For example, in Bangladesh, men expected more educated women to keep their houses cleaner (Lindenbaum *et al.*, 1989). The link between education and environmental health practices through this pathway of changes in social norms is perceptible because environmental health practices require the use of "modern" products, and in the settings where this aspect has been investigated, it has been reported that educated people are expected to and expect themselves to be associated with new ideas and modernism, as seen below.

In Bangladesh, for example, educated women not only tended to emphasise cleanliness and neatness of their houses and children but also were adamant to use tubewell water in their houses, rather than resorting to public bathing or using river or canal water for domestic purposes. In the opinion of the authors this was due to a desire to express social gentility (Lindenbaum *et al.*, 1989). The same study revealed that within that rural community, there was a perceived level of wealth enjoyed by educated women. Their counterparts with no schooling said that educated women could buy soap and pay maids to carry water for them (Lindenbaum *et al.*, 1989). The idea of "identity with the modern world", which as discussed in section 3. 2. 4 . g) had been suggested to explain the links between increased education levels and improved treatment seeking behaviours (Cleland & van Ginneken, 1988; Joshi, 1994) reappears here.

As held by Cleland and van Ginneken (1988), it might be in school that children from deprived families learn to use toilets for the first time and experience cleanliness routines, such as compulsory hand-washing before eating. According to Lindenbaum *et al.* (1989), at Bangladeshi schools certain behaviour styles of the elite are encouraged if not imposed upon them, and the ones related to personal cleanliness seem to be the easier to maintain later on in life, compared to for example quality of clothing or adequate nutrition. These

ideas can then be taken up as socially desirable without the necessary understanding of their potential public health outcomes.

Another attitudinal change is the increased motivation to seek and/or act upon information given by education. This is important because biomedically recommended hygiene, sanitation, and mosquito deterrence practices are characteristically promoted through formal communication channels (e.g., radio, TV and posters) and also through formal authorities such as health services staff. Educated women might be more inclined to respond to these types of messages. Although no empirical evidence has been found to support this link, this motivation has been suggested with regards to treatment seeking behaviour, where educated women were said to seek more medical information and adhere to advice by medical staff (Cleland & van Ginneken, 1988). Another example of this effort to seek information was revealed in Bangladesh where, compared to non-educated girls, all schoolgirls said that they had access to radio, even if they had no radio at home (Lindenbaum *et al.*, 1989). Although their main interest in doing so was to listen to songs, they were exposed to health messages being broadcast and the news (Lindenbaum *et al.*, 1989).

Finally, an important social change that accompanies education is wealth, which is an important precondition for most safe HHEH practices to occur, due to the fact that these practices are conditioned by access to commercially available products.

Autonomy and decision-making power – In much the way as it has been suggested that education related decision-making power and women's autonomy leads to more effective health-seeking behaviours, this characteristic has been suggested to lead to better domestic childcare practices (Sandiford *et al.*, 1997). HHEH practices may be said to fall into this category.

As child-care practices are likely to occur under scrutiny of family members representing different generations, which is typical of African settings, more educated women are more likely to challenge their own

husbands and even their in-laws by asserting school-related wisdom and values against the wisdom of tradition (Caldwell, 1979). Better communication and persuasion skills can facilitate this process, which is referred to by some as bargaining power (e.g., Pfeiffer *et al.*, 2001). This is analogous to the suggestion that better educated women were able to confront medical authorities with more confidence (Cleland & van Ginneken, 1988; Joshi, 1994). In families where the principal caretaker has these skills, it is more likely that younger children get a better share of the food, and that infants are given better-quality weaning foods (Caldwell, 1979). Following that logic, since such families tend to be more child-centred and provide better equity in treatment amongst householders, it could also be the case that other practices related to child care that also contribute to child survival are followed. For example better attention of cleanliness of children and the environment surrounding them and protection of the children against mosquitoes at night.

Although primarily the responsibility of mothers, environmental health practices to protect young children have been described as a product of collective efforts or disputes between mothers, grandmothers and siblings of small children (Halvorson, 2004). This can be applicable in Africa where people live in compounds cohabited by members of extended families. This point is highlighted in the household production of health model proposed by Berman *et al* (1994), which holds that householders combine their internal knowledge, resources and behavioural norms and patterns with external available resources if they are to maintain and promote the health of their members. This is not clearly the work of only one person (i.e., the mother), therefore it may well be that women in such settings often fail to use their decision making power effectively. Hence the possibility of no association between maternal education and improved HHEH practices is raised. Indeed, as pointed out by Barrett and Browne (1996), who could not find significant associations between education and hygiene behaviours, the effect of education might have been blurred because the caretaker was not always able to behave autonomously. This point had been highlighted in a discussion regarding patterns of treatment seeking

(Bicego & Boerma, 1993), which held that most women, regardless of their education status, could still be facing social pressures to maintain traditional, but biomedically defined as harmful, practices to child health. This is probably why potential advantages of maternal education towards child-care practices related to health have not been concretised, as seen with most studies of HHEH practices displayed in Table 3-3 and Table 3-4. However, there is no evidence to support this claim.

Surrogate care, as highlighted in section 3. 2. 4 . a) (Adetunji, 1995; Caldwell, 1979), can further enhance the problem of ineffectiveness of maternal education and decision-making power. However there is still encouragement to continue to investigate the importance of mothers' decision-making power in HHEH practices, even though such practices might also be in the hands of other people, on the grounds that mothers still could retain the overall control of decision-making and resource allocation to benefit the child by enforcing their rules on surrogate carers (Caldwell, 1979).

Widening of social networks - This characteristic has been investigated with regards to patterns of treatment seeking behaviours. Social networks were identified as key factors for the successful pursuit of complex treatment-seeking endeavours (Lindenbaum *et al.*, 1989). In such cases only women with useful contacts (within and outside her village), i.e. to assist with travel expenses, accommodation, cost of medicines, etc., may succeed in providing their children with treatment. As previously discussed in section 3. 2. 4 . g), these women were likely to be better educated. It has also been found in Kenya that adults' number of external social contacts increased significantly with increased years of education (Miguel & Kremer, 2003).

Neither study empirically investigated how the link between social networks and education operates. There is the possibility that such networks widen with the widening of a women's sense of geography acquired in their daily to and fro movements between the school and the home (Lindenbaum *et al.*, 1989). However, it can just be that widening of social networks occurs

because schooling increases the possibility of meeting new people (i.e., colleagues and teachers).

Whilst *autonomy and decision-making power* surface when women interact with people that would normally exert status or economic power over them - that usually happens in the household environment - *widening of social networks* has been noted in relation to how women react to, and mingle with their outside world. As seen in Bangladesh (Lindenbaum *et al.*, 1989), both characteristics are not mutually exclusive, and, most probably, if they are potential products of education they are likely to work together. In the above-mentioned case study, for example, it is highly likely that the educated woman used decision-making power in order to be able to exploit her social networks.

However palpable it is that the social networks can shape treatment seeking behaviours, these factors might not be important for routine behaviours, such as washing hands with soap after potential contamination of hands, or safely removing children's faeces from the environment, or arranging for mosquito deterrence measures at bedtime, which unlike treatment seeking behaviours, are more likely to take place within the domestic confinements therefore not requiring the intervention of outsiders. In this case probably household-level decision-making power comes more into play.

There can however be aspects of household level behaviour which can be influenced by social networks. For instance, one can be in the position to make judgements on benefits of a given technology, based on previous experience with that technology by their peers. This was shown in Kenya, where those more exposed to information about a deworming treatment through their peers were significantly less likely to experiment it, because they already "knew" that the drug was not effective (Miguel & Kremer, 2003). It follows that social networks could be important in explaining how households acquire products such as bednets in places where they are not widely used or available.

3.2.5 The role of environmental health facilities

Conceptually, it may be evident that HHEH behaviours may be dictated by access to improved HHEH facilities. However, these associations are not always easily interpreted. A study in Bangladesh illustrated this point, where women from households using tubewell water for domestic needs were more likely to be observed performing thorough hand-washing (what constitutes thorough hand-washing is shown in Table 3-1) after defecation (Hoque & Islam, 1995). This correlation with water source would make sense if quantity of water available, which was one of the preconditions for thorough hand-washing, was the aspect being captured. Rather, what was being captured was type of water source (tubewell vs. other). In an earlier study in the same population, use of tubewell water showed significant correlation with wealth, as measured by the possession of luxury assets (Hoque *et al.*, 1989). However, in the hand-washing study, possible interactions between type of water source and wealth in explaining the behaviour differentials were not taken into account (Hoque & Islam, 1995). Even less intuitively, having a latrine was a predictor of thoroughness of hand-washing in the same study.

Similarly in Brazil, a significant association was found between the presence of an adequate excreta disposal facility and high hygiene scores, but the hygiene behaviours being measured were not related to excreta disposal; they were to do with hand-washing at critical times and food hygiene. On similar lines, in Burkina Faso, households with a tap in the yard were more likely dispose of children's stools in latrines (Curtis *et al.*, 1995).

Findings like the above have lead to the suggestion that households with better hygiene awareness are more likely to install water sources and latrines in their premises (e.g., Strina *et al.*, 2003). This factor was called "attitude to hygiene" and considered an important but difficult to measure confounder in the relationship between improved sanitation and diarrhoeal disease (Curtis, 1998). If the same logic were to be applied to interpret Hoque's finding (1995), it would follow that women with better awareness of hygiene practices would be more inclined to choose to collect their water from improved sources.

Lindenbaum held that educated women used tubewell water instead of surface water and also maintained themselves and their children cleaner than other women (Lindenbaum *et al.*, 1989). There is therefore the possibility that education explains the ability both to act upon the preference to use improved HHEH facilities and to engage in HHEH protective practices.

Another interpretation of results showing a link between access to water and hygiene behaviours that do not involve water is that since water collection in most settings in the developing world is time-consuming, be it because of distance to the source, queuing time, or intermittence or unreliability of service, improved access to water can save time and energy, which can otherwise be used by caretakers to carry out other essential domestic activities including hygiene practices (Boot & Cairncross, 1993). Such practices do not necessarily involve water use.

A comparative study of two villages in Mozambique provides some evidence for differences in time budgets between women that allocated up to 5 hours of their day to water fetching and those that required 20 minutes (Cairncross & Cliff, 1987). It was shown in that study, that the time saved was not translated into more time for economic productive work, but was for household chores, which included childcare and management of the household environment (Cairncross & Cliff, 1987).

Being served with an improved water source *per se*, such as that described in Bangladesh (Hoque & Islam, 1995) does not necessarily translate into time budget savings for women since women's time budgets are not likely to be affected by the type of water source they are supplied with, but by the distance between water source and home as well as the time spent on queuing at water points (Cairncross & Feachem, 1993). In fact, distance may not at all be relevant because a very close source with long queues or unreliable performance might take up more of women's time than a further away, reliable source with no queues. This means that only studies which measured distance and time-related aspects of access to water source could have captured the relationship held by Boot and Cairncross (1993). While Curtis *et al.* (1995)

acknowledged this possibility, Strina *et al.* (2003) did not. Both studies only had an indication of distance to water source.

Lindenbaum held that women using tubewell water instead of surface water and maintained themselves and their children cleaner than other women did so as an outcome of a desire to express social gentility. This might correspond with the above-listed examples of correlations between hygiene practices and products or technologies that in turn are not necessarily preconditions for such practices (Hoque *et al.*, 1989). Curtis and colleagues (1995) briefly mentioned this possibility but did not explore it further. It can be the case that a common drive, perhaps the expression of status, underlies both the acquisition of modern technologies and the following of certain practices, which fall within the categorisation of HHEH.

3.3 Gaps in the literature

The evidence supporting the argument that women's education may contribute to the improvement of certain health-seeking behaviours, points mostly to those responding to medical interventions. There is still a gap in addressing the relationship with HHEH behaviours. Evidence points to cognitive changes associating risk practices to disease as not being the principal mechanism through which education may work. If it is believed that in some settings people may carry out hygiene and sanitation as well as mosquito deterrence behaviours without necessarily having diarrhoeal disease or malaria in mind, then behaviour change theories focusing on knowledge or beliefs as the basis for behaviour change are of little use in explaining these health related behaviours through education in such settings. Education might confer improved HHEH practices not solely through knowledge of disease causation but because these practices are markers of modernity, which better educated women, and their families, like to be associated with.

The suggestion that less educated mothers can benefit from health services as much as educated mothers is an important detail to consider if we

want to make an analogy to HHEH practices. There is no account in the literature as to whether the same can be true of HHEH practices. If this were true, then it may mean that improved education of women would not lead to behavioural differences if HHEH products were available and readily accessible, meaning that all educational groups would have equal advantage. Education of women would equally not lead to behavioural differences if the products were not available, to the equal disadvantage of all women. Advantages would be conferred solely to educated women if products were available but not easily accessible, and lack of education was mal-adaptive to these barriers.

A major gap in the literature is that most studies investigating determinants of mosquito deterrence practices only looked at the role of head of household's education, or education of the household as a whole, not giving particular importance to the education of mothers, principal caretakers of young children, or even housewives, who have been labelled as key players in various aspects of the management of the household environment in different settings (Baden, 1997; Halvorson, 2004; IIASA, 2001; Katcha & Watts, 2002; White *et al.*, 1972). This is somewhat different from the hygiene and sanitation studies, which were inclined to include women as main actors, possibly because their role with regards to hygiene and sanitation is more obvious. Such gap in the literature regarding determinants of mosquito avoidance practices offer impetus for research on the role of maternal or caretaker's education in determining those practices, including practices other than purchase of bednets.

In order to confirm the above important assumptions, the following step in the research agenda should be to conduct studies specifically designed to assess the relationship between maternal education and hygiene, sanitation, and other environmental aspects of the homes and communities.

Still regarding the role of women in producing HHEH behaviours, conceptually, autonomy was suggested as an important determinant of preventive child-care practices, but no direct evidence exists to support this from the HHEH standpoint, despite the interest by some authors on exploring

the topic. This gap offers great opportunity for an area of research on the influences of women's decision-making power on those practices.

Not only are the relationships between wealth and HHEH yet to be confidently established, but also the rationalization of the relationships found (and not found) has not been clear-cut. The literature indicates that the level of wealth enjoyed by the households facilitates the acquisition of products, especially those requiring medium- and long-term investments, such as latrines and bednets. However this might be a simplistic view of the associations between household level economic status and HHEH practices. For instance, the extent to which social expectations explain differentials by wealth has not been fully addressed.

Measurements of education, wealth, and autonomy have not been consistent across studies, making it difficult to compare the existing results. Wealth variables seem to be more consistent when measured as indexes. Despite the small number of HHEH studies using wealth indexes, and the diversity of outcomes measured, this consistency is encouraging both for the continuation of testing the hypothesis of the relationship between wealth and HHEH and the utilization of a wealth index as an appropriate measurement of wealth in relation to HHEH. Women's autonomy was suggested to be best measured through decision-making power, financial autonomy, and exposure to the wider world, and to be highly dependent on family structures and social norms.

A gap also exists in terms of geographical representation of the existing findings. Examples of studies addressing questions on the role of the factors of interest to this study, especially women's education and autonomy, come mostly from Asia and little is known about whether the same situation holds in Africa. It is important to take into account geographical representation, given the cross-cultural differences involved in the dynamics of running households, which includes production of health behaviours. This brings to surface the importance of cultural values and social norms that might facilitate or hinder HHEH practices.

3.4 Conceptual framework

Based on indications from the literature review, a theoretical conceptual framework for the study was elaborated. The framework, which was proposed in order to guide data collection and assist the elaboration of an analytical plan, represents posited relationships between key HHEH practices suggested to be associated with malaria and diarrhoeal diseases among children under-5 years of age, and factors likely to influence those practices.

In the framework, the environmental health practices of interest to the study are posited as outcomes, which are influenced by a number of variables reflecting characteristics of the caretaker or the household environment. These influencing variables are seen as explanatory or predicting variables. A number of intervening variables are proposed that modify the effect of the relationship between the already referred "outcomes" and the "predicting variables". There are also instances where the outcomes themselves may act as intervening variables or as predicting variables of other outcomes.

The components of the framework are diagrammatised in Figure 3-1 and discussed in more detail below.

3.4.1 Household Wealth

Wealth is suggested to be an important predictor of acquisition of HHEH devices or facilities, specifically latrines, soap, bednets, mosquito coils and aerosol sprays, because their acquisition is assumed to involve financial costs. Consequently, safe disposal of excreta, hand-washing and use of mosquito deterrence products can be influenced by wealth on the grounds that the presence of the above products facilitates the engagement in protective practices more frequently.

Accessible and improved water sources are also EH facilities posited as predictors of hygiene practices. In the case of hand-washing, improved access to water can provide the convenience factor of more readily available water to

facilitate the behaviour. On the other hand, improved access to water can provide more time for hygiene behaviours in general to be carried out.

At the same time, wealth can be directly linked to the performance of protective HHEH practices due to the intention, by wealthier families, to express their high social status through the performance of HHEH practices that incidentally are protective.

3.4.2 Caretaker's education

The conceptual framework rests on the premise that women play an important role in determining the purchase of HHEH products, be it for consciously thought HHEH purposes or for other purposes. For example, soap could be purchased for hand-washing but also for cosmetic reasons. Therefore characteristics of women are crucial components of the framework.

Caretaker's education was thought likely to predict presence and use of commercially available HHEH products because of tendencies of better educated people to relate to modernity, just as was seen with the likelihood of more educated women to seek curative and preventive care at modern health facilities (Bicego & Boerma, 1993; Cleland & van Ginneken, 1988; Hobcraft, 1993; Lindenbaum *et al.*, 1989). It follows that caretaker's education can be inversely associated with use of practices not involving modern technologies (e.g., use of smoke mosquito repellents) because it has been suggested that schooling can give authority for traditional practices to be challenged (Caldwell, 1979).

Another route of influence of education on protective HHEH practices is that increased education is entailed by increased knowledge of disease prevention, which increases the potential of carrying out safer practices.

Education may be an important predictor of HHEH practices, but at the same time associated with wealth, which in turn predicts HHEH practices, as already discussed. Therefore the framework predicts an interaction between caretaker's education and wealth in their association with the behaviour outcomes of interest.

3.4.3 Caretaker's financial independence

Despite the fact that overall wealth status of the household can predict acquisition and use of HHEH products, caretakers' financial independence, irrespective of HH wealth, can also be an important predictor because such products are closely related to their own domestic and caretaking roles (e.g., bathing children, laundering, and protecting children against mosquitoes). In similar ways, lack of women's financial autonomy, irrespective of husbands financial power, impeded appropriate treatment seeking for diarrhoeal disease in children (Halvorson, 2004). Financial independence is predicated to be associated with wealth, caretaker's education and autonomy, therefore the model takes into account interactions between those factors.

3.4.4 Caretaker's autonomy and decision-making power

Caretakers' autonomy and decision-making power were thought to be reflective of the degree of a woman's influential role in the household's bargaining process for the choice of consumables for which acquisition requires relatively large investments and cooperation with other HH members (for example latrines and bednets). Autonomy might also play a role in women's independent initiative to purchase products such as soap, coils, and aerosols sprays. With high levels of autonomy and decision-making power they are expected to have few restrictions from other, more influential people in their close environment, from pursuing the behaviours that they desire. In addition, the likelihood of employing products such as soap for hand-washing and anti-mosquito products for the benefit of children was hypothesised to be a result of caretakers' decision-making power either by reinforcing these behaviours amongst other householders or by having the capacity to take independent initiative to pursue these practices. Autonomy and decision-making power can be shaped by family structures (e.g., household composition, caretaker's relationship with the head of household, and whether the household is nuclear or extended), as well as caretakers' education and financial independence.

3.4.5 Family composition and caretaker's marital status

Family structure and caretaker's position within it, which in the conceptual framework diagram (Figure 3-1) is designated family composition can predict the HHEH practices related to child caretaking namely safe disposal of children's stools, hand-washing after handling children's stools and protection of children against mosquitoes not only because family structures influence women's power position within the HH, but also on grounds that women living close to their mothers have been suggested to receive increased advice and support on caretaking, infant feeding, and domestic hygiene practices (Dearden *et al.*, 2002). Such help and support was expected to translate in greater hygienic practices and mosquito avoidance to protect children, compared to women not living close to their mothers. Likewise, women living under the rules of in-laws have been suggested to have less access to such levels of advice and support due to their fear of approaching the in-laws to discuss environmental health matters, for example the purchase of hygiene products (Halvorson, 2004). Similar influential role of in-laws has also been suggested in studies of determinants of family planning (Hakim *et al.*, 2003) and treatment seeking behaviours (Castle, 1993; Lindenbaum *et al.*, 1989).

Finally, women in nuclear families are expected to have fewer restrictions from other, more influential and feared people in their close environment (in-laws), from pursuing the behaviours that they desire (that is assuming that the above protective behaviours are desirable to them).

3.4.6 Caretaker's exposure to the wider world

Caretaker's exposure to the wider world, partly through the media, was suggested to predict possession of commercially available HHEH products, because through regular listening to the radio or watching television people are likely to come across these products being promoted, resulting in improved awareness of their benefits, hence becoming more inclined to experiment with them. Also through the media they are likely to be more exposed to health

promoting messages, hence more inclined to experiment with products beneficial to health. However, not much is known about whether there were specific messages in the media regarding the practices of interest, therefore a more general effect was expected, i.e., having an awareness of a wider world comprising a great variety of different behaviours leads people to be more willing to experiment. This is in line with Lindenbaum's finding that women with increased sense of geography in rural Bangladesh were endowed with greater ability to obtain treatment from modern health facilities (Lindenbaum *et al.*, 1989).

3.4.7 Caretaker's age

Caretaker's age was considered important because a range of age groups playing care-taking roles was foreseen, including children and the elderly. Firstly, different age groups may relate to different values (e.g., traditional vs. modern), different levels of education, and experience related to management of the household environment, therefore influencing one's cognitions that lead into behaviour. Hence younger generations were thought more likely to pursue more modernised practices.

Secondly, following the suggestion of Scott *et al.* (2003), that women of reproductive age are more inclined to nurturing behaviours (Scott *et al.*, 2003), the conceptual framework suggests that older caretakers would be more likely to perform safer hand hygiene and stool disposal practices compared to their younger, childless counterparts. This is in line with life history theory, which helps explain why people often ignore the long-term consequences of behaviours that produce short-term gain (Hill, 1993), therefore being current mothers are more inclined to pursue behaviours affecting current reproductive success, e.g., caring for an existing child, whereas the young and childless are inclined to invest in behaviours affecting their future reproductive success, which does not include caring for others' children.

In addition, the framework predicts that older caretakers are more likely to have been exposed to past and current, if any, health messages targeted at

mothers of children under-5. Caretaker's age (an indicator of maturity) is also an important variable potentially associated with decision-making power (Castle, 1993).

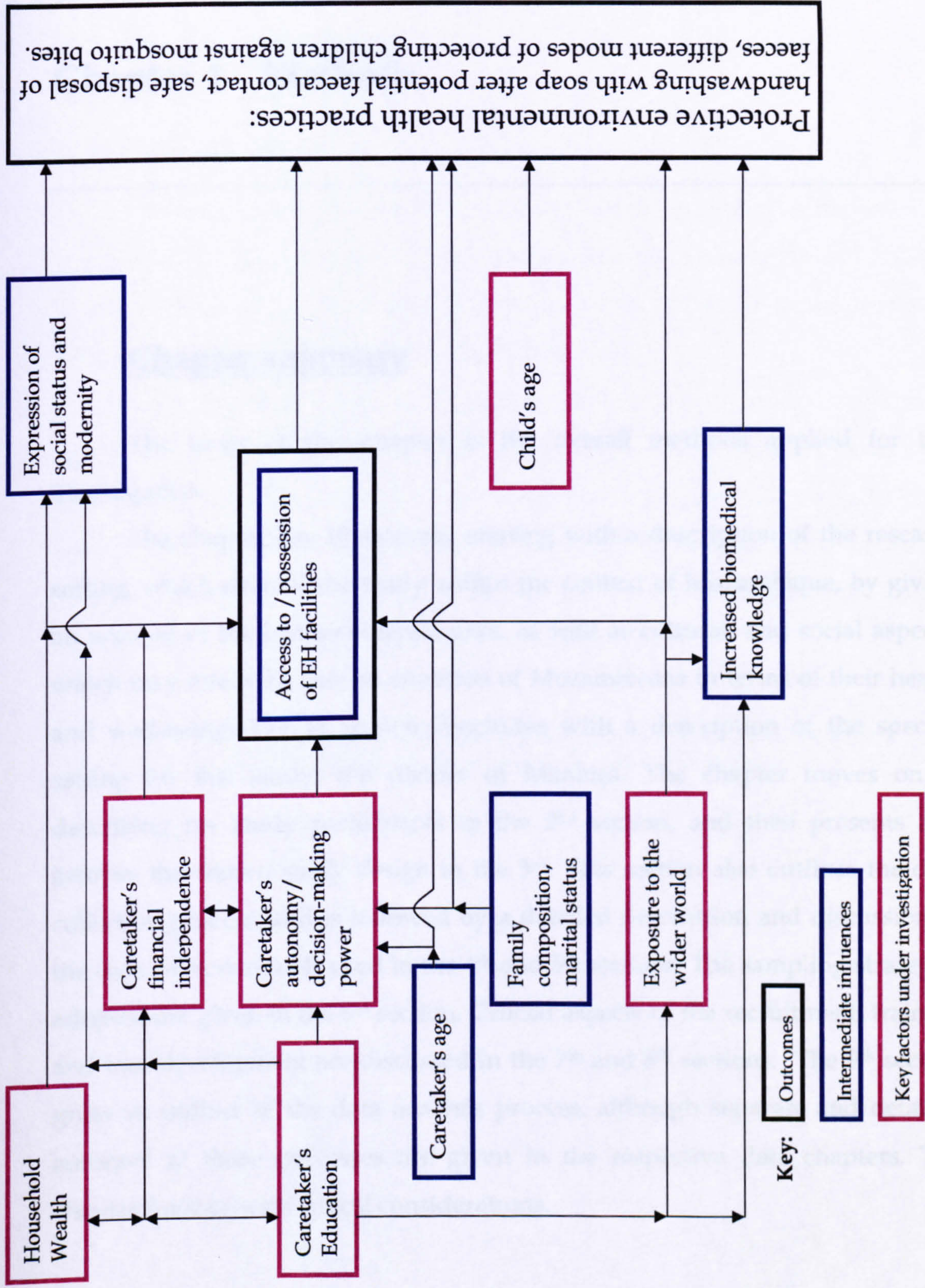
3.4.8 Child's age

Child's age was thought important in relation to sanitary disposal of their stools. On the premises that people might not view young children's faeces as harmful (Curtis *et al.*, 1995; Fukumoto *et al.*, 1989; Kaltenthaler & Drasar, 1996b; Scott *et al.*, 2003) and that the older the child the dirtier they stools were perceived to be (Halvorson, 2004), it was predicted that stools of older children would be more likely to be safely disposed of compared to stools of younger ones, and that hand-washing after handling children's stools would be more likely to be observed with increased age of the child.

The age of the child can also dictate degree of supervision of the child, in terms of time spent with the child and proximity between the supervisor and the child, which in turn can influence the likelihood of safe disposal of child's faeces.

Sleeping arrangements made for the child can also be influenced by the age of the child, therefore it is predicted that likelihood of sleeping under a net is linked to child's age.

Figure 3-1: Conceptual framework for the analysis of factors associated with HHEH practices



Chapter 4 Methods

Chapter summary

The focus of this chapter is the overall methods applied for this investigation.

The chapter has 10 sections, starting with a description of the research setting, which situates the study within the context of Mozambique, by giving an account of the historical landmarks, as well as cultural, and social aspects, which may affect the current situation of Mozambicans in terms of their health and well-being. The 1st section concludes with a description of the specific setting for this study: the district of Manhica. The chapter moves on to describing the study participants in the 2nd section, and then presents and justifies the chosen study design in the 3rd. This section also outlines the data collection process, and is followed by a detailed description and discussion of the data collection tools used in the 4th and 5th sections. The sampling strategies adopted are given in the 6th section. Crucial aspects of the recruitment, training and tool development are discussed in the 7th and 8th sections. The 9th section gives an outline of the data analysis process, although separate and detailed accounts of those processes are given in the respective data chapters. The chapter finishes with ethical considerations.

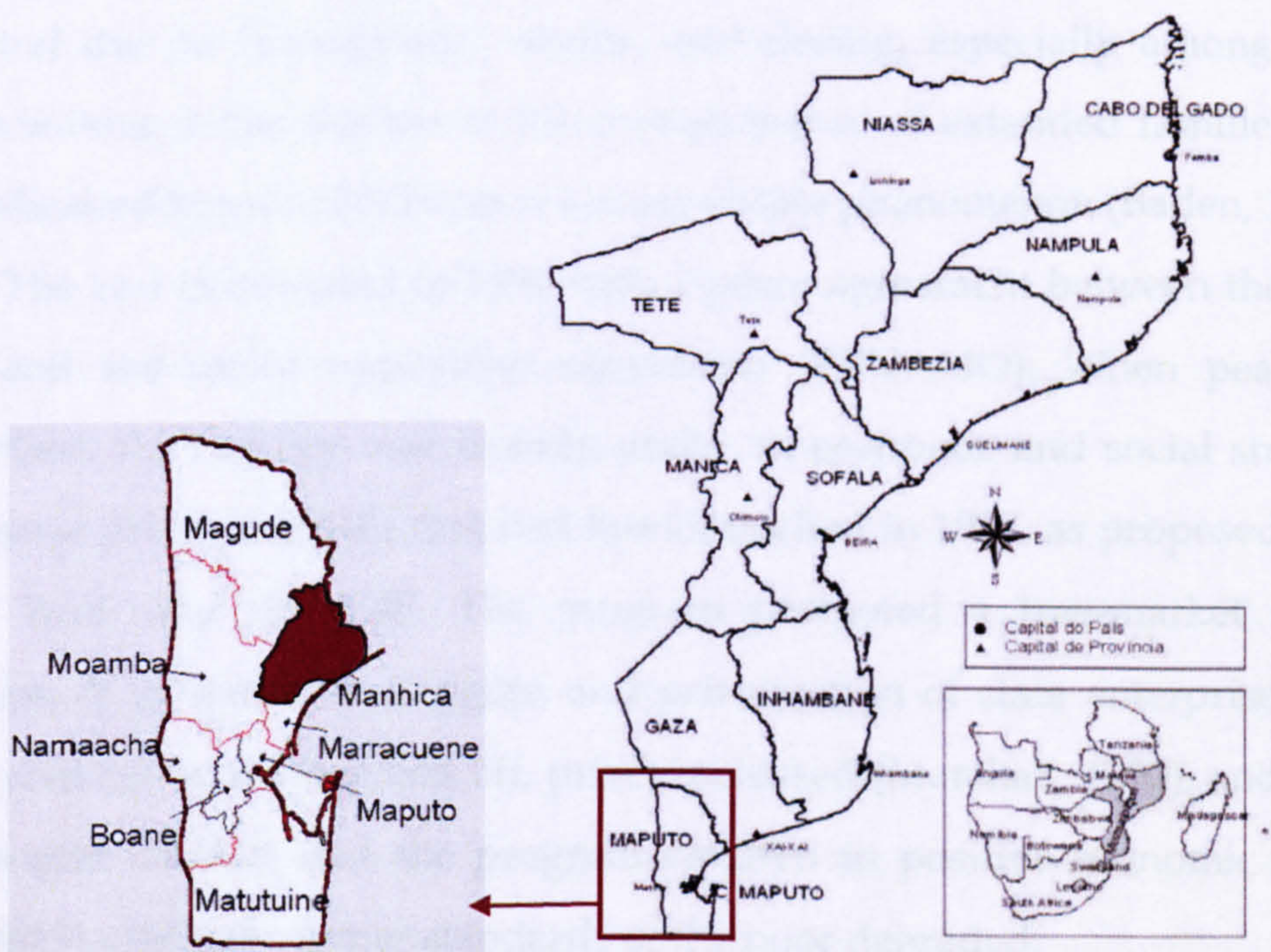
4.1 Research setting

4.1.1 Mozambique

The study took place in Mozambique, which is situated on the south east coast of Africa (Figure 4-1). The country has an area of nearly 800,000 Km² and is administratively divided into 11 provinces and 128 districts. The estimated total population was 18,514,000 in 2003 (INE, 2004).

The official language is Portuguese. While 40% of the population can speak it, only 9% speak it fluently and use it as part of their daily communication (INE *et al.*, 2005). The majority of the population speaks one or more of at least twenty different Bantu languages. Changana, which is the local language in the study area, is the second most used language in the country (spoken by 11%), second to Makhuwa (spoken by 26%).

Figure 4-1: Map of Mozambique highlighting the southernmost province of Maputo, with its 8 districts, of which one is Manhiça (left inset).



Ten years of fighting between the national liberation movement (FRELIMO) and the Portuguese rulers brought to an end a period of colonial

occupation that had spanned through around 500 years, bringing the country to independence in 1975.

Mozambique's first Government opted for a socialist regime, which prioritised major reforms in the health, education, and housing sectors. Until today it is recognised that during that period programs such as EPI reached successful rates thanks to the grassroots mobilisation movements adopted by the regime. It was then that the country reached the sharpest ever reduction in infant mortality rates (INE *et al.*, 2005). On the other hand the new Government abolished many traditional institutions (such as the practice of bride price, polygamy, religion, and traditional healing) and the power of traditional authorities was removed (Baden, 1997). This might have contributed to the vulnerability of most social structures, which is still evident today.

The post-independence structural modifications were not consolidated because, within the first year of independence, Mozambique was struck by a civil war that destabilised the entire country. Not only economic but also social structures were destroyed by the war. In particular, kinship ties were severely disrupted due to kidnappings, deaths, and fleeing, especially among young men, resulting in the decline in the predominance of extended families. Also, female-headed households became a more visible phenomenon (Baden, 1997).

The war culminated in 1992 with a peace agreement between the ruling party and the major opposition movement (RENAMO). When peace was established, the country was already under an economic and social structural adjustment program (PRE) that had been launched in 1987, as proposed by the World Bank and the IMF. The program promoted a free-market system, reduction of government budgets, and privatisation of state enterprises. As a result, civil servants were laid off, prices increased (Marshall, 1990), and wages fell. Despite the fact that the program resulted in positive economic growth rates (MPF, 1996), the living standards of the poor degraded.

Following years of deep economic and social recession, recent statistics presented by the World Bank and the IMF suggest that Mozambique is succeeding in the management of its economy. The rate of economic growth

between 1997 and 1999 was unprecedented, as considered by several policy observers, and has been described by some as the fastest in Africa (Ardeni, 1999). Even with the disastrous effect of the floods in the year 2000, which reduced the GDP's growth, the growth rate maintained a steady positive average (KPMG, 2004).

Despite the fact that industry is now the major contributor to the GDP compared to agriculture (KPMG, 2004), agriculture continues to employ the vast majority of the country's workforce in rural areas (Ardeni, 1999), where over 70% of the population lives (UN, 2000). Around 90% of the agricultural workforce works in the family farm sector (IIASA, 2001). As in the rest of Sub-Saharan Africa, women are the basis of agricultural production, and additionally carry the burden of household chores including food acquisition, cooking, firewood and water collection, childcare, to name but a few (Baden, 1997; IIASA, 2001).

Notwithstanding the so-called unprecedented economic growth, poverty is present amongst Mozambicans in great proportions (Ardeni, 1999), being more prevalent and severe in rural areas than urban (MPF, 1996). However an improvement should be noted, indicated by a decline from 69% of the population living in absolute poverty in 1997 to 54% in 2003 (INE *et al.*, 2005).

The economic and political destabilizations that the country underwent provoked demographic and social changes, such as uncontrollable rural-urban migration, irreversible internal displacement, as well as destruction and slow recovery of social infrastructure in general. This has increased pressure on scarce services (including health and food supply systems), which have influenced the health status of the population, particularly with regards to vulnerable groups such as children under-5 (Macassa *et al.*, 2003). For instance, the General State Budget is still deficient and heavily dependent on external aid, and the government has been spending too little on education, health, infrastructure, and general basic welfare because the financial resources available do not give enough capacity to cover all these expenditures.

The prioritized health programs by the Mozambican Government are based on Primary Health Care with attention to maternal and child health (antenatal care, vaccination, and addressing micronutrient deficiency), health education in schools, and control of HIV/AIDS (INE *et al.*, 2005).

4.1.2 Manhiça

The study site was Manhiça, a Southern district of Mozambique (see Figure 4-1). This district was chosen because a good link already existed between the PI and CISM (Manhiça Health Research Centre). CISM is the country's first peripheral research centre working adjacent to the Manhiça Rural Hospital (MRH) in collaboration with the Ministry of Health (MoH), with financial and technical support from the Spanish Cooperation. Besides giving support to MRH, the centre has set up a Demographic Surveillance System (DSS), which has been running since 1996. The main objective of setting up the DSS was to create a demographic platform to contribute to the research infrastructure of CISM with the ultimate goals of helping implement and evaluate new evidence-based disease control strategies, to inform policy, and to identify priority research areas (Alonso *et al.*, 2002). CISM is a member of the INDEPTH network, an international network of field sites with continuous demographic evaluation of populations and their health in developing countries.

Collaboration with CISM facilitated recruitment of households to the study because a good sampling frame was provided. Further, the study followed the centre's proven acceptable and proficient procedures, such as those for household identification, informed consent for participation, and household follow-up in the case of repeated visits, hence minimizing missing households, refusals, and drop out rates. Another valuable advantage of working in this setting was the provision of logistic assistance, in terms of transport, accommodation, office working space, and fieldwork materials, to name but a few, which facilitated the study in general.

Manhiça, which covers an area of 2,360 Km², is one of 7 districts that compose Maputo Province (Figure 4-1). Approximately 130,000 people inhabited the district in 1997. The Manhiça town centre is located 85 Km North of Maputo city (the country's capital). The town is crossed by the main National highroad and the National railroad (Figure 4-2.a). Around 37,000 people live in proximal neighbourhoods to the town centre and scattered in distal villages surrounding the town (DSS Manhiça - CISM 2000). The DSS covers nearly 18,000 households and 74,000 people.

The district has two distinct areas, one comprising fertile low-lying lands by the river Inkomati, one of the 25 most important rivers (and sources of water) flowing through the country (IIASA, 2001), and the other a flat plateau away from the river, to the West. The latter area is where the majority of the population resides, and the former is used for large-scale sugar cane cultivation and, on a smaller scale, subsistence farming, mostly performed by women. Subsistence farming provides the households with their staple diet, which comprises maize, cassava, and leaves (for example, bitter leaf, cabbage, and sweet potato leaves).

The study population is composed mostly of subsistence farmers and employees of the sugar industry in the neighbouring Maragra village and Xinavane district. The rail and road corridors have turned Manhiça into a trading route; hence a significant number of people, mainly women, are engaged in vending farm and other products in markets and on the streets. Manhiça is a source of migrant labour to the neighbouring South Africa, and owing to this a work-related migration pattern is observed, which, combined with the outcomes of the civil war, resulted in a sex imbalance among adults in Manhiça (Alonso *et al.*, 2002). Further, the district is characterised by a young population, due to high fertility and high mortality rates. Estimates from the latest demographic update show that only 7% of the population is 60 years of age or above (unpublished DSS Manhiça data).

The neighbourhoods along the road tend to be densely populated and have quasi peri-urban characteristics, with a high proportion of houses made of

concrete or daubed walls, surrounded by small, fenced yards. On the other hand, the distal villages are typically rural, with houses mainly made out of bare reeds and thatched roofs. Here the houses are dispersed, and the yards are large, unfenced, and separated by fruit trees and private cultivation plots, also known as *machambas*. These villages have very difficult access to the hospital, conventional communication channels, the commercial network and public services in the town centre, having to walk for up to 2 to 4 hours in order to reach the main town.

The town has one municipal market and one large informal market. Ambulant vendors and vending stalls abound along the main road, and women also sell products in front of their yards. There is a post office, a secondary school, 5 primary schools, a petrol station, a latrine slab production cooperative, some shops, a hardware store, a bakery, a few churches (mostly evangelic), several bars, and food kiosks.

The main ethnic group is the Changana, along with a smaller number belonging to the Ronga group. Both speak dialects derived from the language Tsonga, also spoken in parts of South Africa, Swaziland, Zimbabwe, and other districts in Southern Mozambique. Although Portuguese is the official language, virtually everyone in Manhiça speaks Changana, Portuguese being only spoken at school, offices, public services, or in extremely formal contexts.

Families are traditionally patrilineal, which implies that the children of a married woman belong to her husband's family (Arnfred, 2001). This system, which dominates in Southern Mozambique, goes along with patrilocality, where married women move from their maiden family to live with the husband's family (Arnfred, 2001). However, some mothers still tend to raise their children with the help or advice of maternal relatives.

A great number of people rely on privately-owned water sources, mostly wells and to a lesser extent taps, within their own or neighbouring courtyards.

In terms of health services, Manhiça Health Centre, which has the characteristics of a rural hospital, is the referral health facility of the district,

although people residing in the North-western area use the hospital in the neighbouring district of Xinavane.

Alternative healthcare is widely practiced and sought after, mostly dominated by traditional healers, herbalists, church healers, and drug vendors in the markets. The choice of service sought after is not determined by access to them but rather by the manifestations and perceived aetiology of the ailment being experienced (Munguambe, 2001).

4.2 Study participants

The study participants were drawn from the demographic surveillance platform developed by CISM, which is divided into 33 enumeration areas (EAs). Such enumeration areas were demarcated according to existing *bairros* (neighbourhoods) and villages (Table 4-1).

Each EA has between 1 and 10 zones, and a zone has on average 115 households (range 42-225). Each household (enumeration unit) has a census number that gives a precise indication of the *bairro* and zone where it belongs. Each householder holds a unique identification number (Perm. ID), which gives an indication of the *bairro*, zone, and household where they originally lived when they were censused.

For the purpose of this study, a household was an enumerated unit as defined by the DSS. Household members were the people living in the same enumeration unit, who, according to the respondent, ate from the same pot and had a reserved space to sleep within the unit. Although the definition of household was the same as the DSS's, the definition of householders was slightly different⁸. For example, the DSS will only consider a household member a person that has already been a dweller for at least 6 months, which implies that people who had recently moved to the unit would not count as householders. For this study a householder was anybody who met the above

criteria (eating and sleeping in the same unit), staying over an anticipated period of not less than 6 months. Short-term visitors were excluded from this definition. Secondly, the householder attribute concerning the payment of bills was thought unnecessary to be included in the definition for the purpose of this study.

Having at least one child under 5 years of age by the end date of the fieldwork stage was the main criterion for a household to be included in the study.

Three EAs, namely Ilha Josina village, Palmeira *bairro*, and Mitilene *bairro*, were included in the pilot and qualitative studies and excluded from the main study (see Table 4-2 for fieldwork process). Palmeira and Ilha Josina are situated relatively far from the main surveillance area, and are administratively independent from Manhiça. Ilha Josina is an isolated river island with deep rural characteristics (scattered, thatched huts, owned by farmers, and far from the main town). Palmeira is semi-rural (densely organised houses, with heterogeneous construction materials ranging from reeds to bricks, and a mix of residents, some agriculturalists and others with jobs in the main town to which the neighbourhood is peripheral). Despite belonging to the main study area, Mitilene is one of the furthest away from the remaining neighbourhoods, and has the above-described rural characteristics.

The relative isolation of the above areas was used to the study's advantage in order to pilot the data collection instruments, and conduct the first stage of the study, which was a qualitative study. Both these exercises required separate study populations from that of the subsequent stages of the investigation in order to minimize the potential spillage of information about the study between the two populations.

⁸The Manhiça DSS definition follows the definition from the latest countrywide census (1997). A household is held as a group of people, linked or not by family ties, who live in the same house, share the same bills, and obey the rules by the same household head.

Figure 4-2: (a) Map of enumerated households in the study area (yellow dots). The light blue line is the Inkomati River and the white line is the National road. (b) Map of the *bairros* (delimited by thick black lines) and zones (represented by each colourful area) within the main Manhiça DSA.



Table 4-1: Manhiça DSA households, and households participating in the study, and their distribution among the *bairros*.

<i>Bairro/village</i> name (area code)	Nº of households per <i>bairro/village</i>	Nº of participating households in each data collection stage				
		Qualitative study	HH survey	Structured observations		
				SO-1*	SO-2	SO-3
Maciana (1-13)	3725	-	138	44	43	7
Cambeve (14-20)	1653	-	51	10	6	1
Nwankakana (21)	283	-	16	6	3	2
Wenela (22)	239	-	31	1	1	1
Waxinengane (23)	127	-	-	-	-	-
Ribangua (24)	755	-	7	1	-	-
Manhiça Sede (25)	1018	-	14	9	1	-
Tsatse (26)	580	-	38	10	9	3
Mulembja (27)	528	-	68	7	4	-
Nwajokuene (28)	71	-	12	2	1	1
Maxecane (29)	96	-	19	10	9	3
Mitilene (30)	363	7	-	-	-	-
Manchiana (31)	1123	-	11	4	4	2
Palmeira (32)	3978	8	-	-	-	-
Ilha Josina (33)	1859	8	-	-	-	-
TOTAL	16398	23	405	104	81	20

* SO-1, 2, 3 = Structured observations

4.3 Study design

A cross-sectional study design was chosen to study factors associated with sanitation, hygiene and mosquito deterrence practices in households of Manhiça.

Cross-sectional studies are conducted at one point in time or over a short period of time, providing information on features of a community at that point in time (Kirkwood & Sterne, 2003). They are usually limited for descriptive purposes, but in circumstances where current values of exposure variables are unalterable over time, cross-sectional studies can be taken as analytical (Hennekens & Buring, 1987). The socio-economic and demographic variables of interest to this study (wealth, women's education and autonomy) are potentially alterable but such alterations in most cases are assumed to be gradual, therefore the characteristics of interest can be measured as permanent or semi-permanent. Therefore an analytical cross-sectional design was appropriate for this study.

This design was believed appropriate for the present study as it would apply to both of the above fronts, namely (i) description of behaviour prevalences, and (ii) measurement of associations between hypothesised explanatory variables and behaviour outcomes.

Though the associations found in cross-sectional studies must be interpreted with caution because causation cannot be determined, this type of study is useful for examining elements of potential causal pathways, which also means that these studies can generate hypotheses for future, experimental studies (Hennekens & Buring, 1987). This was another reason for choosing a cross sectional design, since this study is among the first to examine such complex networks of links between environmental health practices and their determinants.

Further, cross-sectional studies have been suggested to be appropriate for the study of outcomes of slow onset and long duration (Ebrahim, 2003). Epidemiologically speaking, such outcomes refer to disease outcomes and the

parameter used to measure them in cross-sectional designs is the prevalence, which reflects the probability that any one individual in the population is currently suffering from the disease (Kirkwood & Sterne, 2003). This study measures human behaviours as the major outcomes, and borrowing from the above suggestion of the appropriateness of cross-sectional studies (Ebrahim, 2003), the behaviour outcomes that this study sought to investigate can be considered as being of slow onset and long duration, as they are expected to reflect habits within the context of daily routines of householders.

However, moderate to high variability of certain hygiene behaviours at individual level, especially hand-washing, were noted in Burkina Faso (Cousens *et al.*, 1996). This was a concern raised by the vast majority of those performing direct observation of hygiene related behaviours. However variable they might be, there is evidence to suggest that they have high consistency at community level, therefore still offering accuracy of prevalence estimations in a population (Cousens *et al.*, 1996). This gives further support to the choice of a cross-sectional design to this study, but using repeated measurements of behaviours to address the problem of variability.

Complementary to the cross-sectional survey, a qualitative exploratory study was designed. This approach was chosen to investigate the meaning rather than establishing the relative frequencies the HHEH practices of interest. Such meanings were sought from the perspective of the study participants. The choice of this as a complementary approach followed the suggestion that a sound mix of qualitative and quantitative data is appropriate in the study of human behaviour (Bernard, 1995). Secondly, qualitative studies are appropriate starting points to investigations of phenomena not yet fully known or documented (Tobar & Yalour, 2002), which was the case for certain behaviours in this study and in this setting.

The data collection stages and methods applied in this study are summarised in Table 4-2.

Fieldwork of the main survey and the observational component of the study were conducted from June to November 2003, preceded by a pilot and a qualitative study, from September to December 2002.

Table 4-2: Outline of the fieldwork process

Stage of the study	Timing	Tools	Sample
Qualitative study	Sept 02 - Dec 02	Focus group discussions	12 groups of mothers, grandmothers and fathers of small children
		Semi-structured interviews	23 households
Pilot			
Pilot			
HH Survey	June 03 - Oct 03	Socio-demographic and economic questionnaire Autonomy and decision-making questionnaire Spot observations	405 households
Observational study	Aug 03 - Nov 03	Structured observations:	
		First round	104 households
		Second round	81 households
		Third round	20 households

4.4 Data collection tools for the qualitative study

Qualitative methods were used in order to view the problem questioned by this study from the perspective of the study population. Using qualitative techniques as complementary to quantitative techniques to study the same topic has been considered useful in producing a general picture of the problem (Bryman, 1988).

This study made use of semi-structured interviews and focus group discussions, which are detailed below.

4.4.1 Semi-structured interviews

Semi-structured interviews were conducted with caretakers of children under-5. These semi-structured interviews were designed to cover the same ground across respondents, exposing each individual of the sample to the same stimuli by asking them the same set of questions (Tobar & Yalour, 2002). However, all responses were open-ended and prompting was allowed, in order to further clarify respondents' views on the matter being questioned, in case the response was felt to be ambiguous.

Although designed to generate qualitative data, the structured form was chosen over the unstructured in order to facilitate the systematisation of the data analysis process, given the limited time allocated to this study and limited sample size. It has been said that less structured, in-depth, interviews often originate unique interviews, therefore various conversations over long periods of time (e.g., ethnographic research) might be needed before obtaining a set of similar data from each informant from which to detect patterns of the phenomenon being investigated (Tobar & Yalour, 2002).

Interviews were done in order to gain insights into what might drive or hinder people to acquire and use certain HHEH products (latrines, soap, bednets and alternative forms of mosquito deterrence).

The interview schedule was divided into 6 sections. The first 5 sections were each dedicated to people's experiences and attitudes regarding one type of HHEH product or technology, namely bednet, alternative mosquito deterrence products, traditional and improved latrines, and soap. In each section the following aspects were investigated:

- a) **To those possessing and using the HHEH product or technology of interest (soap, latrine, mosquito deterrence product):**
 - Mode of acquisition, including costs, and householders involved in the process of acquisition

- Reasons behind acquiring it
- Most likely people in the house using those products and reasons why
- Experienced advantages and disadvantages of using the technology
- Levels of satisfaction with regards to current products, and if dissatisfaction detected, contemplation towards improvements
- If not entirely satisfied, whether considering alternative products and why
- Their views on those not having or not using the above technologies (i.e., whether there was anything particular about the people that did not have them; what did they make of those people)
- Their own behaviours involving the product (e.g., hand-washing with soap at critical junctures, children using latrines)

b) To those not possessing the technology:

- Awareness of the existence of the product, cost, and mode of acquisition
- Whether ever considered acquiring it
- What was used in the place of the inexistent product
- Advantages and disadvantages of current alternatives
- Barriers to acquisition
- Their views on owners and users of such product
- Who would be the potential users and why

The 6th section explored what the respondents personally thought could cause *dzedzedze* (fevers with headaches and shivers, which some people mentioned interchangeably with *malaria*), malaria, and diarrhoea.

The principal investigator (PI), who had 2 years experience interviewing, and 3 trained female field assistants conducted the interviews, which took approximately 60 to 90 minutes in each household.

Interview responses, which were mostly in Changana, were recorded by directly note taking on the spaces provided in the interview schedule, which was written in Portuguese (Appendix 10).

4.4.2 Focus group discussions (FGD)

The FGDs employed in this study were based on what has been termed as structured group exercises with target participants (Baker & Hinton, 1999), facilitated by the PI and a field assistant. While the PI's main role was to observe and record the discussion (by direct note-taking), the field assistant directed the discussion by following a guide (presented in appendices 8 and 9) and allowing the PI to intervene in case the discussion deviated from what was intended from it.

The target participants were mothers, grandmothers and fathers of children under-5. In order to minimise the problems of relations of power and control that could affect the outcomes of the FGD (Baker & Hinton, 1999), participants were divided in groups according to age and gender.

Two exercises with visual aids, adapted from the PHAST⁹ toolkit, were employed.

The first exercise, *Enfermeira Felicidade*, originally *Nurse Tanaka* (Wood *et al.*, 1998), is a technique which ignites discussions about local perception of diseases. It leads the participants to identify frequent and assumedly important health problems in the community concerned, from their own perspective. An illustration of *Enfermeira Felicidade*, at the hospital to receive her patients, was passed around. The facilitator then showed a series of pictures, one at a time, each illustrating a single patient not necessarily showing signs of specific diseases or illnesses. It was up to the participants to decide the reason why each patient had gone to see the nurse. Whenever a disease was mentioned, the

⁹ PHAST (Participatory Hygiene and Sanitation Transformation) is an approach developed by WHO and the UNDP/World Bank's WSP. It involves specific activities, using visual aids that stimulate people to discuss in groups faecal oral routes of disease transmission, in order to revisit their own hygiene behaviour and think of ways to avoid risks to disease. In countries like Mozambique, the application of this approach has been expanded to research and education in other areas, e.g., malaria control (Dooley 1999).

facilitator led the discussion into its signs and symptoms. Having the participants gone through all the pictures, the facilitator drew the discussion back to those illnesses with diarrhoea, malaria, and fever-like symptoms, asking the participants what could have the patients done to prevent such problems. It was expected that people would talk about the illnesses based upon their own experiences, of their neighbours, family members, and friends.

The second exercise was the *three-pile sorting*. The discussion was stimulated by illustrations to represent environmental health-related scenarios. The first step was for participants to organise the illustrations into “acceptable” and “not-acceptable” practices or conditions. A third pile was for illustrations towards which most participants were indifferent, or where there was no agreement between them as to whether they were acceptable or not.

Participants were encouraged to talk about the feelings they had towards the practices or products they found “unacceptable” and then the facilitator went through the “acceptable” illustrations following the same approach.

4.5 Data collection tools for the quantitative study

With the objective of collecting information on social, economic, demographic, and environmental characteristics of households and/or key individuals within the households, a survey was carried out. Four field workers were involved in the survey, directly supervised by the PI.

Each fieldworker was allocated a number of neighbourhoods and was given the list of selected households within those neighbourhoods. The list had the DSA household number, the Perm ID and full names of the head of households and resident children under-5. Each week fieldworkers reserved 1-2 mornings to locate the households they expected to cover within the following days.

After greeting and a brief explanation of the objective of the visit, the interviewer asked the householder that received them whether the children

listed for that household were indeed residents at the time. If more than one child currently resided in the household, a random selection procedure followed to elect the index child (4.5.1.c). Then, the interviewer asked for the index child's caretaker, i.e., the person responsible for bathing, feeding, putting to sleep, and supervising the child. This person would be the respondent.

The respondent was usually the index child's mother, if present. If not present, arrangements would be made for a second visit when the mother was more likely to be present, if this was not possible it was a sign that the child was not under the care of their mother on most occasions, therefore the person in charge of taking care of the index child during the day would become the respondent and the principal caretaker henceforth¹⁰.

On one visit the fieldworker used the following instruments to collect data: a socio-economic and demographic questionnaire, a questionnaire on caretakers' autonomy and decision-making power, and finally spot check observation on the conditions of the yard. The whole procedure took approximately 90 minutes to complete.

4.5.1 Socio-economic and demographic questionnaire

As with all the tools used for this study, the questionnaire was written in Portuguese but was administered in the language that the respondent was most comfortable with (Portuguese, Changana or Ronga).

The questionnaire, shown in Appendix 6, was divided into 7 sections, labelled A-G, and described below:

a) *General household information*

This section, which followed a small section on whether the household accepted to participate in the study (and, if not, for what reasons) had 6 questions eliciting information about the neighbourhood in which the

¹⁰ In case a caretaker different from the principal caretaker was observed performing the behaviours of interest in the subsequent home visits, a separate visit was arranged in order to administer the questionnaires to that particular caretaker.

household was located, household number, number of people, number of children and languages spoken by the householders.

b) Head of household (HoH) details

In this section the respondent identified the HoH by indicating the person who ruled the household, and had the final word on major decisions. Regarding the HoH, information was collected on his or her age, sex, marital status, education, occupation, income, and relationship to the index child.

c) Index child details

Since it would be impractical to involve every child under care, one child per household was chosen for the purpose and that child remained as the index child throughout the study.

The index child was the resident child under 5. In case more than one child under 5 resided in a household, their names were noted down on small pieces of paper, which were folded over, and the respondent was asked to randomly choose one. This procedure was carried out after a brief explanation of the study and before the informed consent was read out.

The following data on the index child were collected: the index child's Perm ID number, sex, date of birth (and age), and relationship with the HoH.

d) Mother or caretaker details

In this section the fieldworker noted down whether the respondent was the index child's mother and, if not, the relationship between the respondent and the index child. Where applicable the fieldworker further wrote down the reason why the mother was not interviewed and the principal caretaker position was therefore assigned to the person responsible to watch over the index child in the absence of the mother, in case it was declared that the mother was permanently or mostly absent.

Information was collected on age, education attainment, whether ever enrolled in adult literacy programs, ability to read, occupation, income, religion, and marital status.

e) Details of caretaker's partner

This section, with questions similar to those asked about the HoH, was filled in only if the caretaker was married or had a partner, and if the partner was someone other than the HoH.

f) Household environmental health data

Caretakers were asked about environmental health conditions and habits, including type and location of source of drinking water, latrine possession and whether in working condition, latrine use by the index child, index children usual defecation sites if not always in the latrine, mosquito avoidance techniques (in the index child's bedroom and other rooms) used on the previous night and previous season, and possession and uses of soap. Two questions were dedicated to caretaker's own habits, namely hand-washing mode, and disposal of the index children's stools, both questions referring to the latest actions taken (either on the day or the previous day).

g) Further indicators of living conditions

Besides information on people's occupations and incomes on the previous sections, this section was another major source of data for the wealth scale. Possession of valuable assets was enquired about, namely of functioning radios, television sets, irons, motorised vehicles, bicycles, livestock, and cultivation fields.

4.5.2 Questionnaire on women's autonomy

In this questionnaire respondents (caretakers)¹⁰ were asked about their position within the household dynamics in the decision-making process over resources and actions, as well as their own sense of economic and social

independence among the householders, exposure to the outside world (through reading, watching television and listening to the radio), their support network, and their feelings towards domestic punishment following the failure to properly execute their daily chores. The items measured by this questionnaire were:

- Who usually has the final word or is expected to take independent action in the following matters: (i) daily food purchases; (ii) treatment to seek when the index child is ill; (iii) treatment to seek when the caretaker is ill; (iv) purchase of caretakers own clothing
- Proximity of caretaker's current residence to her maiden family's (parents and/or siblings)
- The degree of autonomy the caretaker has over money (i.e., whether she manages her own money or depends on others')
- Whether the caretaker accepts to be punished (e.g., through being beaten) by household members following negligence in her domestic chores
- Degree of exposure to the media (radio, television, newspapers)
- Caretaker's participation in women's credits and savings associations (locally referred to as *xitique*)

The questions were used as a scale (caretakers autonomy and decision-making power), which was developed on the basis of a study analysing the Indian National Family health Survey to determine the effect of improved female status on child health (Sallee, 2001).

It should be noted that indeed, like in south Asia, gender inequalities exist in the context of the present study, but the dimensions of such inequalities are expected to be somewhat different. For example, seclusion of women is not a prominent feature, at least in the Manhiça context. Movement of women beyond the home or neighbourhood is common, if not necessary, as their chores include trips to the public water sources, health clinics, and markets, which are

not always in the vicinity of their households. In addition, differently from certain of the studied communities elsewhere (e.g., Hakim *et al.*, 2003), people are not subject to strong religious ideologies that prescribe physical exclusion of women from public male space. In agreement to what has been generally documented in Africa (e.g., Castle, 1993, Caldwell and Caldwell 1987), the dimensions particular to this setting are the separation of spousal budget and gender-differentiated domestic roles. Therefore decision-making power, and financial independence rather than mobility, were taken as more crucial dimensions of autonomy to be taken into account in this study.

Hence respective adaptations were made to the scales used in India and Pakistan (Hakim *et al.*, 2003; Sallee, 2001). The fully translated version of this questionnaire is given in Appendix 7.

4.5.3 Spot-check observation

Spot-check observations are recordings of behaviours or visible, physical characteristics of interest at one point in time (Boot & Cairncross, 1993).

Spot-checks are used as a means of collecting various time allocation data. In the context of the study of hygiene related behaviours, they have been used as one-off observations per visit, which is what happens in most KAP studies (e.g., Dooley, 1999). One-off spot-checks are viewed to be rapid and unobtrusive, and most likely to capture products of behaviours rather than the behaviours themselves (Ruel & Arimond, 2002).

A spot-check observation was carried out in each household once the questionnaires were completed, on the first visit. The data were recorded on a pre-tested form (Appendix 8) containing pre-coded categories of the observable household environmental conditions listed below.

- Housing type (type of wall and floor in the main building)¹¹

¹¹ The main building was the quarter where the indoor common area was located. If no such area existed, it was the sleeping quarter of the HoH. It is in the main building where most valuable goods are usually stored.

- Placement of kitchen utensils in the yard (whether on the floor or elsewhere)
- Evidence of stool removal from the yard through engaging in spotting any human stool within the yard
- Traces of yard sweeping, judged by visibility of broom marks and accumulation of debris on the ground

Additionally, environmental health conditions were recorded through spot-checks during the structured observation period¹² and recorded in the same record sheet for the structured observation (section 4.5.4), as follows:

- Presence of a latrine, and whether in use
- Characteristics of the latrine (slab, seat, and superstructure material)
- Cleanliness of the slab area and latrine floor
- Covering of the latrine squatting hole with a lid
- Presence of hand-washing facilities and hand cleansing agents (soap or alternatives) in latrine or immediate surroundings
- Traces of yard sweeping
- Water storage conditions (whether indoors/outdoors; whether containers were covered)
- Placement of water handling devices and kitchen utensils
- Traces of mosquito deterrence products, early in the morning, in index child's sleeping quarters
- Visible gaps in walls and eaves spaces in index child's sleeping quarters.

4.5.4 Structured observations

The outcomes in this study are EH practices. Questionnaires based on recall are the most widely used tool to document those practices. However this technique's ability to address aspects of apathy, recall bias, and respondent bias

has proved questionable in the investigation of current sanitary practices. The latter form of bias is owed to over reporting of desirable practices (Manun'Ebo *et al.*, 1997; Stanton *et al.*, 1987), especially if the questions are too direct, but also under-reporting if questions are left too open (Manun'Ebo *et al.*, 1997).

Long before their recent and increasing application in the study of hygiene behaviours (e.g., Biran *et al.*, 2005; Curtis *et al.*, 1993; Hoque *et al.*, 1995; Huttly *et al.*, 1994; Omotade *et al.*, 1995), quantitative observation techniques have had a history in their application in animal studies, for example to investigate primate behaviours (Altmann, 1974). They have been useful approaches to generate quantitative data in the field of anthropology, especially in time-allocation studies (e.g., Borgerhoff Mulder & Caro, 1985; Panter-Brick, 1992, citing Panter-Brick 1989).

However, in the context of HHEH, they have the problem of being costly and time-consuming, implying restrictions in sample sizes. With two exceptions (Curtis *et al.*, 1995; Strina *et al.*, 2003), sample sizes of studies involving direct observation of hygiene behaviours have not gone beyond a few hundred households, most of them falling below 100 households. Further disadvantages of direct observation techniques in general and of structured observations in particular include reactivity, where the observed deviate from their usual behaviours due to the presence of an observer (Borgerhoff Mulder & Caro, 1985), and intra- and inter-observer reliability, where biased and imprecision errors arise from variation within and between observers (Martin & Bateson, 1986).

On the other hand, structured observations, unlike spot-check observations, have the ability to record behaviours continuously. One strong point of this technique is that it forces the researcher to carefully think about the behaviours of interest in order to have them explicitly defined by the start of the data collection process. Quantitative observation techniques, such as structured

¹² Observers were instructed to ask permission to use the latrine and visit the index child's sleeping quarters on arrival, and the yard conditions shortly after that, and in the end of the observation, water storage conditions.

observations allow rigorous statistical analysis, empowering investigators to make rigorous cross-culture comparisons (Borgerhoff Mulder & Caro, 1985). This was said to help address the very point of anthropological studies, which is to compare and contrast across different cultural settings (Borgerhoff Mulder & Caro, 1985).

In this study, structured observations were conducted in order to quantify directly observable individuals' hygiene and sanitation behaviours that fall within the categories of risk or protective for diarrhoea as suggested by the literature.

Up to 3 rounds of structured observations were conducted in a subsample of households that had been randomly selected from the surveyed households. Participants made an informed decision to participate in this exercise, as during the survey period permission had been asked for future morning visits, although the exact date, or time, was not specified at the time¹³. Each fieldworker was allocated 30 to 35 households. The schedule of visits was done to reflect the order in which they had been visited on the household survey. Each observation session started as early as possible in the morning, usually 6:00 a.m., but no later than 7:00 a.m., and lasted between 4.5 and 5 hours¹⁴. This period of the day was chosen because it was posited as the time when most household chores (such as cooking, cleaning, water collection and personal hygiene practices) take place, according to the findings from the pilot study.

Observers were equipped with a stopwatch, a pen, record sheets, and a clipboard. The record sheet used for the observations was a pre-tested, pre-coded form containing structured categories of sequences of behaviours likely

¹³ This procedure was found to be acceptable, as in rural Mozambique although women are very busy with their chores, their diaries and timetables are not very strict. Furthermore, from what had been explained in the invitation, respondents were aware that a visit did not mean they would have to interrupt their daily activities; therefore the exact day of the visit became less of a matter of concern.

¹⁴ The main reasons for variations in starting times were: (i) delays due to unavailability of a free driver to take the team to remote areas, (ii) waiting around until at least one householder was present. In the rare instances where observations took less than 5 hours, it was because all householders had to leave the house.

to occur (Appendix 9), as suggested by findings from the pilot study and earlier studies in the field (Curtis *et al.*, 1995; Huttly *et al.*, 1994). Behaviours were recorded under the following categories:

- a) Whenever child defecation occurred, the following information was recorded:
 - Age of the child
 - Whether s/he was the index child
 - Relationship to the head of household
 - Defecation site
 - Whether anyone cleansed the child's bottom, and if yes the actor's identity and relationship to the child and the cleansing material used
 - Whether and where the faeces, and any material soiled with faeces (e.g., nappies, pants, cleansing material) were disposed of, by the end of the observation period, and by whom.
 - Whether, how, and with which cleansing agents, hands were washed after cleansing the child and/or disposing of faeces or any material soiled with faeces.¹⁵

- b) Whenever any household member used the latrine, the following information was recorded:
 - Identity of the individual, sex and, if the latrine user was child, the age
 - If the person was a child (defined as under the age of 16), the age was registered and the time they took inside the latrine. If the time was at least 2 minutes, then the event was recorded as suspected defecation.

¹⁵ If the observer lost sight of the individual being observed immediately after the key event occurred, the sight of wet hands was used as a proxy for hands having been washed and further details of handwashing mechanisms were treated as missing values.

- Whether, how, and with which cleansing agents, hands were washed after using the latrine.¹⁵

The behaviour sampling rule followed here, as suggested by Martin and Bateson (1986), is most appropriate to capture rare but significant types of behaviour, often performed in sequences. In this case are behaviours around child defecation outside latrine and latrine use by other household members, and, even rarer, hand-washing after potential stool contact. Continuous, as opposed to interval observations were conducted and the observer started to record the behaviour once the sequence had begun instead of doing it at predetermined time instants or intervals, chiefly because of the rarity of the events proved elsewhere (Huttly *et al.*, 1994). Recordings were event-based but not with respect to hand-washing, i.e., making annotations only when hand-washing behaviour was observed, missing out on all the other occasions where hand-washing was critical but did not occur. Instead, the events on which recording was based were 2 types of potential faecal contact: handling child's faeces (cleaning the child's bottom and/or removing the faeces) and latrine use by any householder. These constituted opportunities for hand-washing to occur and served as "triggers" for recordings of sequence of events to begin, regardless of whether hand-washing would occur in the end. In this way it was possible to determine on what proportion of occasions that a person's hands were potentially contaminated, hand-washing actually did occur. In case it did occur, all possible modes of hand-washing were recorded, from simply rinsing the hands to the use of any cleansing agent.

Observations were non-participant. The observer sat quietly in a corner where most of the yard was visible, watching the whole group of visible householders, and recording each occurrence of behaviours considered as key event, whenever they occurred. In case the observer lost sight of a person whilst the behaviour was being recorded, the observer was allowed to move, as much as discreetness was allowed, to regain sight of the performer. If not, a missing

value was assigned to the respective unobserved point in the pre-coded sequence of the behaviour.

Throughout the structured observation period, the principal investigator (PI) accompanied the team to the field and paired up randomly with one of four field assistants at a time. Rigour of the structured observation technique was enhanced through daily debriefing with the observers, whereby in a group discussion, each observer not only reported on their observation session, but also shared with the group the highlights and interesting aspects of the household visit. This was also an opportunity for the PI to check on the forms for inconsistencies and for the field assistants to clarify them whilst their memories were still fresh. It was also the time to discuss any difficulties that arose in the field, to prepare fieldwork materials, and arrange the logistic requirements for the following day.

Variability may be influenced by reactivity to the presence of an observer, and to address this problem authors have suggested at least 2 observation sessions per household (Cousens *et al.*, 1996; Gittelsohn *et al.*, 1997; Gorter *et al.*, 1998). Hultly *et al.* (1994) cautioned that 1 day's observation may not be representative. Nonetheless no specific recommendations were drawn on how to handle behavioural data originated from repeated measurements for the purposes of analysis beyond description. Data from repeated measurements are used inefficiently, as it is usually the case that data from the first observation only are analysed. Even if there are only data for one visit, in cases where the same event occurs more than once, repeated data also end up discarded (e.g., Manun'Ebo *et al.*, 1997). The description of how variables subject to repeated measurements were handled is given in section 4.9.2 . b).

4.6 Sampling strategy and sample size calculations

The methods applied at the different stages of the study as shown in Table 4-2, required different sampling strategies and rationale for sample size calculations.

4.6.1 Qualitative study

The strategy adopted here was to cover areas of Manhiça that would not be involved in the subsequent household survey and structured observation to allow for isolation between the households involved in the qualitative and those involved in the quantitative study.

To allow for such isolation, the further apart the 2 study populations were from each other the better. As detailed in section 4.2, Palmeira and Ilha Josina were chosen for being semi-detached from the main study area. To represent the main study area, the northern area of Mitilene, which is one of the furthest away from the remaining neighbourhoods, was chosen.

A number of 25 households was decided upon for the semi-structured interviews, which was determined pragmatically based on time and budget allocated to this part of the study. Households were selected by the random walk method. In each of the 3 chosen areas, the representative of the local authority (e.g. *Secretário do bairro*) accompanied the team to the centre point of the *bairro* or village (e.g. where the major meetings are usually held), where each team member spun an empty bottle to dictate the direction the walk should take for household selection. Every 5th household on the direction taken was selected for interviews on that day.

A household would be taken as a participant household provided that at least one child under-5 was resident and their mother or principal caretaker was present and willing to be interviewed. If the household did not meet the criteria, a next-door house was visited and checked for the stipulated inclusion criteria.

Because the overall study had its focus on families with children under-5, mothers of children in this age group were chosen to participate in the FGDs. Additionally, there was an interest to investigate the problem from the perspective of other actors: grandmothers of children under-5, which might be directly involved in childcare matters and HHEH practices, and fathers which represent the typical heads of households and likely to have an indirect but influential role.

FGD participants were selected in the following manner. A period of 3 weeks was allocated for FGD work, where 4 consecutive working days were allocated for work in each of the 3 neighbourhoods: 1 day to meet the *Secretário do Bairro* (the highest administrative authority representative at neighbourhood level) and 3 to carry out the FGDs. In each neighbourhood, the *Secretário do Bairro* was kindly asked to help identify and invite 10 mothers, 10 fathers, and 10 grandmothers of children under-5 to participate in 3 separate meetings to discuss issues related to child well-being. As a result, 5 meetings were held in Ilha Josina¹⁶, 3 in Mitilene¹⁷, and 4 in Palmeira¹⁸.

4. 6. 2 Household survey

The sample size calculation for this part of the study was based on the formulae for the comparison of two proportions, π_1 and π_0 (Kirkwood & Sterne, 2003), assuming a power of 80%, as follows:

¹⁶ In Ilha Josina, the *Secretário do Bairro* managed to organise a meeting with grandmothers in the same day that the study team approached him. The number of grandmothers was twice the number stipulated, therefore half of them were asked to come back on the following day for a meeting, because they were very keen to participate. Similarly, on the third day over 20 mothers turned up therefore half of them were advised to come back the following day. An extra day had to be arranged in order to hold an FGD with fathers. Therefore in this neighbourhood, 2 extra FGDs were conducted, compared to the stipulated number.

¹⁷ In Mitilene, only 3 FGD were held, according to the schedule.

¹⁸ In Palmeira, one extra FGD with fathers took place because in the first scheduled meeting with them there were too many candidate participants, half of them were kindly asked to leave and return the following day for the discussion.

$$N_1 = \{u \sqrt{[\pi_1(1 - \pi_1) + \pi_0(1 - \pi_0)]} + v \sqrt{2 \bar{\pi} (1 - \bar{\pi})}\}^2 / (\pi_0 - \pi_1)^2$$

Where:

- N_1 is the parameter to be calculated, and is the minimum sample size required in terms of households to be found in each group (exposed and unexposed);
- v defines the level of confidence desired. If $\alpha = 0.05$ then $v = 1.96$;
- $u = 0.84$ if power = 80%;
- π_1 is the prevalence of behaviour outcome (e.g., proportion of houses that safely dispose of stools) that we predicted to find in the unexposed group (e.g. low economic status);
- π_0 is the prevalence of the behaviour outcome that was predicted to be found in the group exposed to the factor of interest (e.g., high economic status);
- $\bar{\pi} = (\pi_1 + \pi_0) / 2$;

To take into account the unequal group sizes, the final sample size (N) was calculated for different prevalence levels of exposure using the formula:

$$N = (N_1 \times c) + (N_1 \times c \times f)$$

Where:

- N_1 would be the number required for equal-sized groups (exposed and unexposed).
- c is the ratio of the larger to the smaller group
- f is the adjustment factor to obtain the size of the smaller group

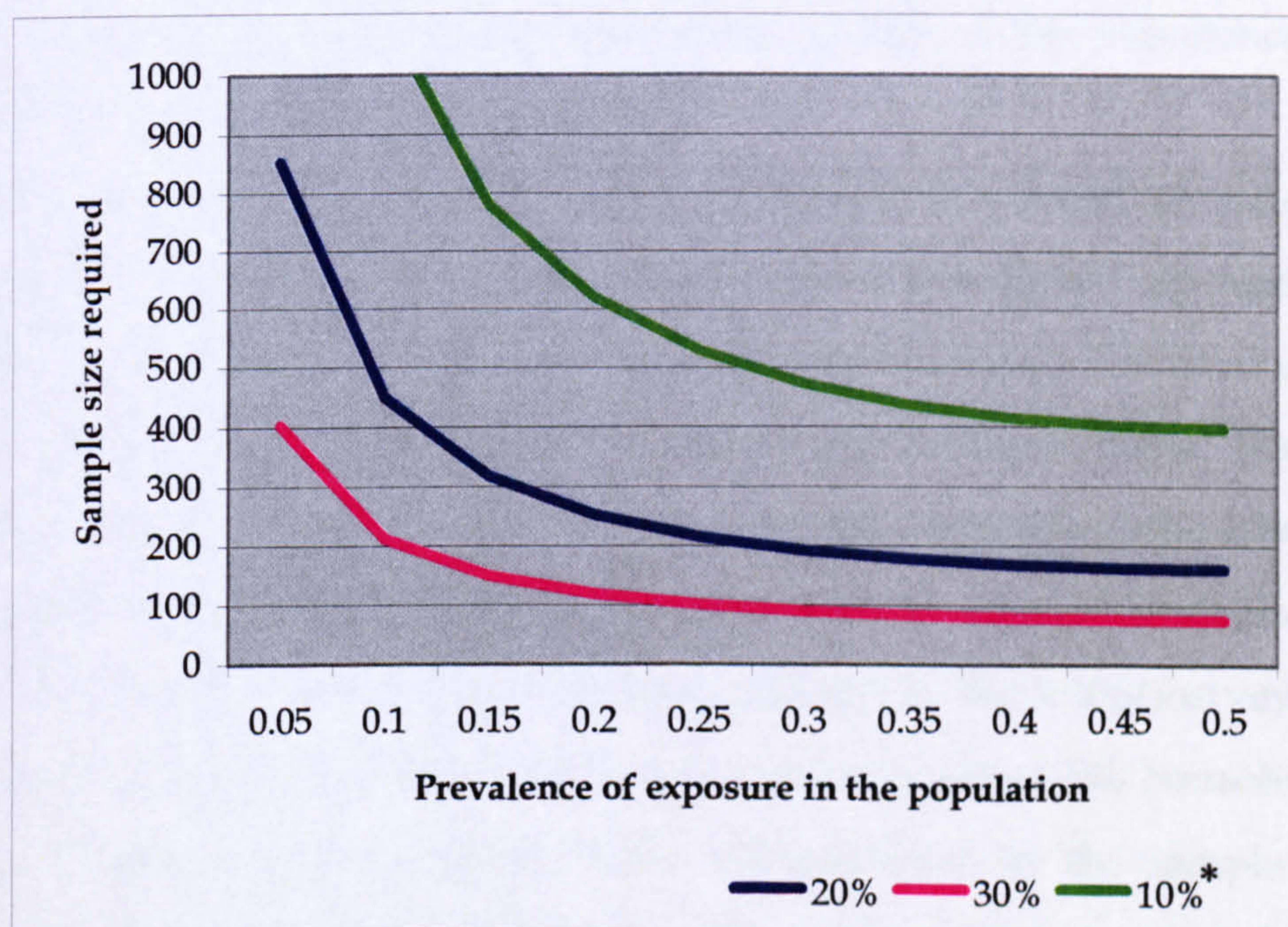
This study involved a large number of outcome variables (behaviour outcomes) and hypothesised exposure variables, therefore it was impractical to

separately calculate the required sample sizes for every possible exposure/outcome correlation.

Instead, a simulation of different possible scenarios in terms of prevalence difference of the behaviour outcome between the exposed and the unexposed, under different and successive prevalences of the exposure, was computed, and the sample sizes required for the survey were chosen.

As can be seen from Figure 4-3 a sample size of 400, which was the foreseen feasible size for the survey, allows the detection of a 10% difference in the outcome of interest if the prevalence of the exposure in the population is at least 40% ($\alpha = 0.05$, 80% power). For example, if 40% of the population has a high educational status, and amongst the highest educated stratum 20% of mothers dispose of their children's stools safely compared to 10% in the lowest educational stratum, this sample size will be able to detect this difference assuming an 80% power.

Figure 4-3: Sample sizes required to detect 3 levels of differences in the prevalence of behaviour outcome, between the exposed and the unexposed, considering a range of possible proportions of households exposed to the factor of interest.



* Predicted prevalence differences between exposed and unexposed

The existence of a demographic surveillance system in Manhiça was the main strength for the sampling strategy, which was the simple random sampling scheme. Through the database of all DSA households, a sampling frame of all households with at least one resident who would have not reached 5 years of age by the end of the field work stage (i.e., by end of November 2003), was defined.

Then households from Ilha Josina, Palmeira, and Mitilene were removed from the list because these neighbourhoods had participated in the pilot and qualitative study.

To select the households for the survey, using Microsoft Excel a list of random numbers was generated, each of which was assigned to one household in the sampling frame. The list was then sorted numerically and the first 420 households were selected for the survey.

4. 6. 3 Structured observations

According to the sample size calculations, illustrated in Figure 4-3, a minimum sample size of 102 can detect a 30% difference in the outcome of interest between the exposed and unexposed groups, if the prevalence of the exposure in the population is at least 35%.

The final decision on the number of houses was based on judgement, whereby the advantages of a large sample size was weighed up against the feasibility of multiple visits during the timeframe allocated. The final decision was to opt for a small sample size to allow for multiple visits. The major implication for this is the decrease in the power in determining the strength of associations between the behaviours outcomes and the suggested factors.

The list of households that had been selected for the initial survey served as a sampling frame from which to further randomly select 110 households for structured observations, in excess of the 102 predicted by the sample size to allow for refusals and loss to follow-up. The random selection procedure was the same as that followed to select households for the survey.

The selected households were visited when the survey was halfway through, provided that they had already been visited for the survey. Eighty-one of those households were available for a second visit. A third round, where 20 households were visited, was done to allow investigation of reactivity and repeatability, which is beyond the scope of this thesis.

4.7 Recruitment and training of fieldworkers

Three field assistants for the qualitative study were selected from a group of inactive CISM staff that were waiting to be assigned to a forthcoming clinical trial. They all had experience of conducting questionnaires, were all mothers of small children, resided in Manhiça (although only one was originally from Manhiça) and had all completed 6 years of education.

Training, which lasted 10 working days, took place in the afternoons. Emphasis was given on conducting and note taking for the semi-structured interviews. The selection and training of the person with the best FGD facilitation skills also took place then. All field assistants participated in FGD training, which consisted in role-playing, where the PI acted as a facilitator and the trainees acted as the FGD participants. Two sessions were run as follows: one session using *Nurse Felicidade* technique and another using *three pile sorting*. Following that, the trainees practiced the techniques with members of staff of CISM as participants of the FGDs. The PI also took the opportunity to practice note-taking from the FGDs. It was then that the selection of the FGD facilitator took place.

Training of the semi-structured interviews also took place with CISM staff members as respondents, and the PI observed the performance of each trainee in turn.

The remaining days in week 2 were used for debriefing, where the trainees reflected on their strengths and weaknesses and the PI gave feedback on what she had observed that needed improvement. This period was also used to refine the tools.

After the qualitative study, these field assistants were trained to use the structured observation schedules, the development of which was still on-going. Initial piloting of the tool took place during such training.

Recruitment and training of field assistants to carry out the household survey and structured observations took place in May 2003. This period was also used to conduct the final piloting of the data collection tools and the translated information sheets for consent.

There were different reasons why a new team was formed. Firstly the earlier team comprised people that had been employed by CISM for quite some time, and this probably reflected on an apparent barrier between householders and the fieldworkers. Ultimately, in the aspect to achieve the goals of the first stage of the study, the benefits of their links with CISM outweighed the liabilities. There was a limited time allocated to the pilot and the qualitative study, therefore working with employees of CISM saved the time it would have taken for recruitment and familiarisation with the study area. Secondly, it was felt during the pilot that there was a need to recruit field assistants with a higher level of education than level 6, which would translate into fewer limitations in their writing skills, which were crucial for the proper management of the long and complex questionnaires and observation schedules.

In order to carry out the survey and the structured observations, four fieldworkers (2 females and 2 males) were selected and trained. They were all secondary school graduates and were fluent in both Portuguese and the two main local languages (Changana and Ronga). They were insiders in relation to the studied population, because they were residents of Manhiça and were very familiar with the selected neighbourhoods. Three of them had never been employed by CISM before, adding value to the "insider" nature of the team. This contributed to the establishment of a good rapport with the communities.

The first 4 weeks after recruitment were solely dedicated to training. The approach used during training was task-based. Due to the complexity of the demographic set-up, the first component of the training was the familiarisation

with the centre's household numeration system, whereby trainees learnt to promptly reach any household, given only the DSA enumeration code for the household. During the final days of this aspect of the training, team members were each given the enumeration label of 6 houses which they had to identify and ask for the "family name" (often the surname of the head of household), which would then be checked against the household database on their return to the centre.

Informed consent practice was also a strong component of the training, where team members spent several days practising the consent with each other and then with neighbouring households to the research centre, most of them belonging to CISM and hospital employees, who agreed to participate in this task.

Regarding the tools to be used, emphasis was given to the structured observation schedule. Trainees not only practiced the observation and recording techniques to be used in this study, they also practiced aspects related to discretion and attitudes of the observer towards the observed, with emphasis on behaviour conducts and dressing codes that went in accordance to the local culture.

4.8 Tool development

Questionnaires and observation instruments, developed in London by the PI, were piloted in a sample of households of villages within Ilha Josina, Palmeira, and Mitilene, after the qualitative study had finished.

The same field assistants that helped conduct the qualitative data collection carried out the pre-testing along with the PI.

In order to ensure that they were appropriate for this setting, the questions on women autonomy, used in previous studies in India and Pakistan (Hakim *et al.*, 2003; Sallee, 2001), were administered to 20 women, chosen by the field assistants and the contents of the answers were discussed between the PI

and the field assistants. As a result, certain items of the original scales were removed and others, thought appropriate to the setting were incorporated, not necessarily to substitute the ones that were dropped. For instance, it was predicted and confirmed through observations and informal conversations with various persons in Manhiça that women in that region were quite mobile and very likely to go beyond the confinements of their compounds without need for consent of others, contrary to what was suggested in Pakistan, that only the most autonomous women enjoyed free mobility (Hakim *et al.*, 2003). Therefore the question on whether the woman was mobile or confined (Sallee, 2001) was dropped. Further, it was found that women were reluctant to discuss the matter of domestic violence. Specifically, it was impossible to find out whether a woman had ever been beaten up by the husband or others in the household. As this question was too sensitive it was adapted so that it would be asked indirectly, in such way that the question revolved around a hypothetical situation (e.g., "would you accept to be beaten up as punishment for not fulfilling your role as a wife/caretaker?"), rather than respondents' own experiences.

Whist being trained for the household survey and structured observations, the new team of field assistants fully participated in the final development of the observation tools (structured observations and spot checks), which were the most complex and demanding in terms of standardisation. Their major inputs were to pinpoint ambiguities in the items of the observation record sheets, and together with the PI those ambiguities were resolved by reformulating the items. Also they revised all the pre-coded categories in the questionnaires and observations record sheets and suggested categories that either were unforeseen by the PI or were not picked up during the pilot study.

In order to carry out the structured observation training, every morning observers were paired-up, and each pair was sent off to a household near the research centre. Ten households had been selected for this purpose, and all but one had at least one child under 5. The remaining household had a child that had just turned 5 years of age.

The pairs of observers carried out simultaneous but independent structured observation sessions. Although data were recorded at the same time, each observer recorded their observations in their own observation schedule. After the observation session, for each group, the PI compared the two observers' data. Data that showed disagreement were marked and in the afternoon training session, observers were asked to describe what they had observed in relation to that particular disagreement point. Problems and solutions to increase agreement on that particular point were discussed. Where possible, the question and the options for possible answers were reformulated to minimise ambiguities. In the following morning, particular attention was given to the previously disagreed-upon questions to see if there was any improvement. In most cases there was improvement. After 2 weeks of this routine, the questions that were consistently unreliable were removed. This exercise maximised inter-observer reliability, although statistical tests to assess inter-observer reliability were beyond the scope of this study.

4.9 Data management and analysis

4.9.1 Qualitative data management and analysis

Data from 23 interviews and 12 FGDs were retrieved and analysed by the PI using NVivo, which is a specific computer software for qualitative data analysis. Details of the analysis process are presented in Chapter 10.

4.9.2 Quantitative data management and analysis

a) Data entry and cleaning

Data entry, which began in Manhica and was completed in London, was carried out by the PI.

The Epi-Info package, version 3.2 (CDC/WHO 2003) was used for data entry. Since the data were single-entered, automated rigorous checks (e.g.,

restricted ranges for numerical data, assigned legal values, and consistency checks between related variables) were introduced to the data entry form. Quality was further assured by the fact that the PI performed all the data entry.

Using StatTransfer, data were exported to the statistical package STATA, version 8.0 (StataCorp, 1984-2006) for cleaning and analysis.

During the data cleaning process, missing values were revised and discrepancies were addressed by checking against the original questionnaires and observation forms. If a discrepancy could not be resolved, a query was sent back to Manhica, where a field assistant re-visited the household(s) for confirmation of the data. This was only possible for questionnaire data and not structured observation data, as the structured observation data were revised on the same day that the data had been collected and field workers were able to clarify to the PI any discrepancies there and then, as described in 4.5.4 .

b) Data analysis

Descriptive statistics was the first step in the analysis, to reveal frequency distributions of important demographic and socio-economic variables, the results of which are presented in the next chapter.

The demographic and socio-economic explanatory variables were combined into scales using factor analysis, which is described in Chapter 6. The data transformation through factor analysis provided numerical variables, which were then expressed in quartiles for further analysis of associations between them and the behaviour outcomes under investigation.

Prevalences of the major hygiene, sanitation and mosquito deterrence practices were calculated, from information collected in the survey questionnaire, spot-check, and structured observations.

Repeatedly measured variables were treated as follows. For descriptive purposes, repeatedly measured categorical variables were combined so that each instance when the behaviour was observed contributed as a single data point so that when relative frequencies of the behaviour categories were calculated the denominator was the number of times the behaviour had been

observed and not the number of households where the behaviour had taken place. Binary variables were expressed in terms of whether the protective side of the behaviour was observed on all occasions, some occasions, or none of the occasions where the behaviour took place. For analytical purposes, these variables were then recoded to give binary outcomes, so that for each practice two categories of households were obtained, one comprising those households where the practice was *ever* observed and the other of households where the practice was *never* observed given that the opportunities to have done so were observed.

Univariate analysis was performed to explore relationships between the behaviour outcomes and posited explanatory variables originated from the conceptual framework (Figure 3-1). In univariate analyses results were expressed as stratum-specific odds ratios (OR) with 95% confidence intervals. For the significant associations ($p < 0.05$), Mantel-Haenszel odds ratios were computed, also with 95% CI and these results were tabulated.

Multivariate analysis followed to establish the joint effect of associations between each behaviour outcome and the range all variables crudely associated with it.

Finally, clustering of behaviours was investigated, using principal components analysis, which is detailed in Chapter 9.

4. 10 Ethical considerations

This study was reviewed by two ethical committees. Ethical clearance for the study was firstly obtained from the National Committee of Bioethics for Health, within the Mozambican Ministry of Health (Appendix 1). Following that, an approval was granted by the London School of Hygiene and Tropical Medicine's Ethics Committee (Appendix 2).

The study objectives were explained to the local authorities of every participant *bairro* or village. Information on the study objectives and procedures was read out to each questionnaire respondent (mothers or caretakers of the

children under investigation). The information given stressed that participation was voluntary, and participants were free to withdraw from the study at any point if they felt that the questions or observations were too intrusive or for any other reason. The same applied for the participants of the FGDs.

Participants gave consent by signature or fingerprint (Appendix 5), and a written copy of the information sheet was given to every participant (Appendices 3 and 4).

Chapter 5 Descriptive results

Chapter summary

This chapter is organised in 4 sections. The first section justifies the need to a descriptive overview of the studied households' characteristics. Following the introduction, a short description of the methods used is provided. The results section starts with an account of the selected households that ended up not participating in the study. The results section continues by presenting the demographic, social, and economic characteristics of the study households and finalises with a subsection describing the physical characteristics of the households, including housing type and environmental conditions in which they subsist. The final section, discusses the findings within a the broader context of existing data on Mozambique, and explains how these data are used for further analysis.

5.2 Introduction

While Chapter 4 (sections 4. 1 and 4. 2) provided a background to the study in terms of the historical, political, social, economic, and cultural characteristics of its geographical area, namely Mozambique in general and the district of Manhiça in particular, this chapter concentrates on characteristics of the sample of households under investigation.

The importance of understanding the context in which households subsist in order to better study health-related behaviours has been highlighted, on the grounds that elements of such context provide key factors affecting the

options available for households to engage in such behaviours (Berman *et al.*, 1994).

The criticality of understanding the social and economic context is marked in this study because the research questions are precisely on whether social and economic related variables explain HHEH behaviours. Part of those explanatory variables has also demographic components. Thus, as a way into understanding the context in which the outcomes of interest of this study operate, this chapter describes the social, economic, and demographic characteristics of the study households, and key householders, which might ultimately influence the HHEH practices under study.

As far as individual characteristics of householders are concerned, the focus was on the head of household (HoH), the index child and the principal caretaker¹⁹. The HoH deserved attention because the level of wealth of a household is suggested to be dictated by social, economic and even demographic characteristics of the HoH, such as education, occupation, and sex.

Caretakers of children under-5 were of importance because the behaviours under investigation were expected to be performed or influenced by them. The choice to emphasise the caretaker is supported by positions taken by those developing models to explain household level production of health (e.g., Harkness & Super, 1994), who highlight the importance not only of the physical and social environments surrounding the child, as well as the cultural customs of child rearing, but also the characteristics of the caretakers.

Finally the index child was important because, as seen in later chapters, certain practices that were observed or reported in this study involved children or ultimately affected children.

Most of the data under consideration in this chapter underwent transformation into scales, which became the set of explanatory variables for further analysis.

¹⁹ Definitions for household, HoH, and principal caretaker are found in Chapter 4 (sections 4.2 and 4.5.1).

5.3 Methods

The data presented in this chapter were obtained from the household survey questionnaires and spot observations (described in Chapter 4, section 4.5).

Data were tabulated in form of frequency distributions.

For the discussion the data are complemented with information from the Manhiça DSS and reports from nationally representative surveys, for example Mozambique DHS (INE *et al.*, 2005) and UNDP development reports (UNDP, 1997; UNDP, 2002).

5.4 Results

5.4.1 Participating households

Four-hundred and five households took part in the survey. For the reasons listed in Table 5-1, 15 households, equivalent to 3.6% of the initially selected HH, were not able to participate

Table 5-1: Reasons for not participating in the survey

Reason for not participating in the survey (n=15)	Number of households
Refused to participate	6
Moved out between latest database update and recruitment	5
Index children died between latest database update and recruitment	2
Incorrect information (youngest child was over-5)	1
HH was in mourning (loss of HoH)	1

5.4.2 Demographic, social, and economic context

a) Household composition

The 405 households who completed the questionnaire contributed a total of 710 children under-5 years of age under the care of the respondents.

Households consisted of a median of 6 members, and 2 children under the age of 5. However these medians offered wide ranges, as can be seen from Table 5-2. Fifty five percent of households had more than 1 child less than 5 years of age at the time of the questionnaire.

Households tended to be headed by the father of the index child, and amongst those households where neither of the child's parents was the HoH, children were more likely to be living with their maternal grandparents or uncles than with paternal relatives.

Table 5-2: Demography of the households

Demographic characteristic (n=405)	Parameter and measure
Number of householders	Median (range) 6 (2- 28)
Number of children under 5	Median (range) 2 (1- 9)
Head of household sex	Freq. (%)
Male	323 (80)
HH Ethnic group	Freq. (%)
Changana only	304 (86)
Ronga only	45 (13)
Other single ethnicities	5 (1)
Changana and Ronga	10 (3)
Other mixed ethnicities	41 (10)

Not surprisingly the majority of households were Changana, as this district is predominated by this ethnic group. Very few instances were found where households were of mixed descent between 2 or more ethnicities, as can be seen from Table 5-2. Other ethnicities in the sample were, Bitonga, Xitsua, and Chope from Southern Mozambique, Chuabo and N'dau (from central

Mozambique), Makonde and Makhuwa (from Northern Mozambique), and Zulu from South Africa.

While 19 (5%) households stated that Portuguese was their first language, in 113 (28%) it was spoken on a regular basis but as a second language.

b) Characteristics of the index children

There were more males compared to females, among the index children (see Table 5-3). The average age of these children was 2 years and 2 months.

Table 5-3: Characteristics of the index child

Characteristic (n=405)	Parameter and measure
Index child age in months	Mean (SD) 26 (14)
Index child sex	Frequency (%)
Male	218 (54)
Index child birth order	Frequency (%)
1 st born	108 (27)
2 nd - 3 rd child	160 (40)
4 th - 12 th child	137 (34)

c) Household headship

Over half of the heads of household (HoH) were the fathers of the index children. In the remainder of male-headed households, grandfathers and uncles, mostly maternal, also assumed headship positions.

Female-headed households accounted for one fifth of all households, the majority of them (37%) being the maternal grandmothers and mothers (34%) of the index children. In most of these households the heads were widows or emigrant workers' wives whose husbands were working in South Africa and only came home once a year for the Christmas holiday. Due to this phenomenon, the study initially considered 2 head of household definitions, namely *de jure* and *de facto* (UNDP, 2002). The HoH was primarily defined as

the person, locally known as *mhunu wa muti*, who was the main breadwinner and had the final word on major household decisions. It was usually, but not always the eldest man in the house, especially if he was economically active. This was the *de jure* HoH. However, in the case of this study, if the *de jure* HoH was not an effective resident in the household (for instance, a miner that spent most of the year in South Africa), further queries were made to the questionnaire respondent to establish who was currently assuming such responsibilities, and this person would be the *de facto* HoH. In 10% of the households where the HoH was mostly absent, for example for migrant labour, the *de jure* HoH continued to actively support their households. Furthermore, these men communicated with their wives on a regular basis, allowing themselves to participate in the household's decision-making processes. In these instances they were considered as HoH.

Table 5-4: Attributes of the HoH

HoH characteristic (n=405)	Parameter and measure
Education (years)	Median (range) 4 (0-12)
Relationship of HoH to index child	Freq. (%)
Father/step father	219 (54)
Mother	34 (8)
Paternal relative‡	59 (15)
Maternal relative†	93 (23)
Employment	Freq. (%)
Unemployed/housewife	25 (6)
Subsistence farmer	113 (28)
Agriculture labourer	36 (9)
Other labourer	10 (2)
Vendor	66 (16)
Skilled activity	56 (14)
Migrant labour in South Africa	39 (10)
White collar job	60 (15)
Income	Freq. (%)
None	71 (18)
Irregular	101 (25)
Regular	222 (55)
Unknown	11 (3)

‡ Grandfather, grandmother, or uncle

† Grandfather, grandmother, uncle, or aunt.

Eighty percent of household heads had had some formal education.

The most common activities among HoH were subsistence farming and trading of products similar to those described for the caretakers. The educated elite consisted mostly of clerks, teachers, policemen, and army officers. People carrying out non-specified manual "odd jobs" were categorised as "other labourer". Other occupations in this category included bricklayers, gardeners, and guards. There was a small proportion of unemployed HoH, which included full-time students.

Sixty-five percent of the respondents who declared that the head HoH was salaried were reticent to disclose their incomes. Therefore income was not taken as a key variable for the analyses to come. However, of the 187 householders where the HoH's salary was revealed, the mean amount earned

per month was MZM 800,000²⁰ if the head was male, and nearly 1/5 of that amount in female-headed households. It should be noted that the majority of the respondents disclosing of their salary held non-agricultural jobs. Further, amongst earners the income range was quite wide (100,000 - 5,000,000). The highest salaries were those of migrant workers in South Africa.

d) Characteristics of the principal caretakers

Caretakers were the index children's mothers in 92% of the households, and they had an average age of 30 years.

Around 70% of principal caregivers declared having been enrolled in a formal school at some point in their lives, and 48% declared that they were able to read, for example the Bible or text from leaflets.

Additionally, 32 women had participated in adult literacy programs. However, only 10 of them had not received any formal education prior to enrolling in the adult literacy program, and over ½ of them had had 4 to 6 years of formal education. Of the women that had participated in adult literacy programs, 15 had done so for less than 1 year, and the maximum number of years was 2, which was accomplished by 6 women.

Table 5-5 shows that nearly 1/3 of the principal caretakers were housewives, followed by vendors and subsistence farmers. There was suspicion of under-reporting subsistence farming as an occupation among the caretakers because through the observations it was possible to see that most of the mothers that had declared that they were housewives were actually subsistence farmers who worked on small allotments nearby the house early in the morning, leaving their children under the care of others. Those engaged in income-generating work were mostly vendors of fruit and vegetables in markets, along the streets and in front of their compounds. There were also charcoal makers and brewers of the traditional cane liquor. A minority had white-collar jobs (teachers, lab technician, clerk, and political activist).

²⁰ MZM - Mozambican Metical is the national currency. The exchange rate stood at around MZM 38,000 to £1 at the time of data collection.

Nineteen per cent of the principal caretakers were involved in the informal savings and credit scheme known as *xitique*. The groups usually comprise sisters, sisters in law and close friends, but often are composed of fellow market vendors, amongst whom a degree of trust has been established.

Table 5-5: Characteristics of the principal caretaker

Caretaker's characteristic (n=405)	Parameter and measure
Age in years	Mean (SD) 30 (11)
Relationship with index child	Frequency (%)
Mother	372 (92)
Maternal relative	24 (6)
Paternal relative	9 (2)
Marital status	Freq (%)
Married/partner (cohabiting)	270 (67)
Married/partner (not cohabiting)	82 (20)
Divorced/separated	36 (9)
Widow	17 (4)
Religion	Freq (%)
Zionist	126 (31)
Other protestant	208 (51)
Catholic	35 (9)
Islam	6 (2)
None	30 (7)
Formal education (years)	Median (range) 3 (0-10)
Employment	Freq (%)
Unemployed/housewife	118 (29)
Subsistent farmer	95 (24)
Agriculture labourer	52 (13)
Other labourer	14 (4)
Vendor/trader	113 (28)
Skilled activity	8 (2)
White collar job	5 (1)
Income	Freq (%)
None	214 (53)
Irregular	121 (30)
Regular	70 (17)

5.4.3 The Domestic Environment

The typical households were dwelt by single families, either nuclear or extended, as opposed to clusters of multiple, sometimes unrelated families living in the same compound, as has been described in other African settings (e.g., Clarke *et al.*, 2001; Curtis, 1998; MacCormack & Snow, 1986).

Each visited house had one or more buildings built within the yard. In general, the main building was used as the head of household's sleeping quarters and/or the living room, where most of the household valuable goods were stored. The more relatives dwelled in the household, the more secondary buildings existed in the yard. These buildings were often made of less expensive materials than the main building. This was where children would sleep if they were no longer at the age of sleeping with the mother.

Table 5-6: Physical characteristics and facilities of the participating houses

Characteristic or facility (n=405)	Frequency (Percentage)
Housing type (walls)	
Cement or zinc	79 (20)
Reeds daubed with mud/cement	137 (34)
Bare reeds	188 (46)
Latrine ownership	
Yes	386 (95)
Main water source type	
Tap	252 (62)
Standpipe with pump	81 (20)
Well	71 (18)
River	1 (0)
Main water source location	
In-house	50 (12)
Neighbouring house	211 (52)
Public	144 (36)

As can be seen from Table 5-6, main buildings were mostly made of reeds and in a number of houses the reed walls were lined with mud. Cement

walls were observed in 20% of the houses. The majority of houses were tin-roofed, with concrete or dirt floors.

It is in the yard that virtually all the domestic activities occur (especially women's work), where visitors are received, where householders rest and children play throughout the day. The most visible part of the yard is the cooking area, which is not always walled or roofed. Water is usually stored in this area and if the cooking area is not roofed, the water is taken to the main building at the end of the day. Thirty-six percent of households being studied used water sources from the public domain, meaning that most water sources were private. Houses did not have taps inside and only 12% had the water source within the yard. Of these the majority were taps (68%) and protected wells (22%). For most of those that did not have taps or wells within their yard the main water source was from neighbouring compounds.

Wealth related characteristics did not seem to determine whether the water source was private (i.e., own or neighbours) or public, as occupation and salary status of either head of household or principal caretaker did not predict ownership of a water source in the yard.. However, compared to those collecting their water from neighbours or public sources, in households with their own water sources, the principal caretakers and the heads of household were more likely to have had at least one year of formal education²¹. Moreover, in the same households, the head of households were more likely to be male.

Most houses had a latrine within the yard, and had a bathroom in a corner at the back of the yard and if the yard had a latrine it was adjoined to the bathroom, separated by a reed wall. Wastewater drained naturally from the bathrooms. Water used for washing clothes, dishes, or for other domestic activities was usually thrown to a corner within the yard, but hardly accumulated because the soil is semi-permeable.

²¹ Correlation between water source ownership and caretakers education: $X^2 = 4.61, p = 0.032$.
Correlation between water source ownership and HoH education: $X^2 = 4.81, p = 0.028$.

There is no refuse collecting service in the area. Garbage was seen thrown on to a heap in a corner of the yard or a hand-dug pit which with time, either became a heap or it was covered in sand and a new pit was dug elsewhere.

Over half of the households had livestock. Animals, especially poultry, ducks, and pigs, were free ranging and spent most of the time around the kitchen area. The few houses that claimed to pen the animals did so at night in order to protect them from theft. Rearing free-range animals was said to save time and money that would be used for feeding them. As can be seen from Table 5-7, although animals were used for cash generation, it was not common for households to rear animals exclusively for trade. They were mostly used for consumption, having 2% of households revealed that animals were reserved to be served to important visitors.

Table 5-7: The uses of livestock amongst livestock owners

Objective of animal rearing (n=221)	Frequency (%) of households
Own consumption only	164 (74)
Own consumption and trade	52 (24)
Visitors only	4 (2)
Trade only	1 (0)
<i>Total</i>	<i>221 (100)</i>

5.5 Discussion

The characteristics of the studied population are similar to those reported in Mozambican country representative surveys (INE, 1996; INE *et al.*, 2005). Results demonstrate that the majority of this population live in economically poor conditions, which must not be ignored during the whole process of analysing and interpreting the results of the present study.

Twenty percent of the surveyed households were female-headed. The latest official statistics showed that country wide, 26% of rural households are female-headed (INE *et al.*, 2005). The proportion of female-headed households

is similar to that reported in other similar settings in the context of household environmental health studies, e.g. Malawi (Ziba *et al.*, 1994).

It has been suggested that female-headed households are more likely to live in poverty. From the latest Mozambique DHS, it was seen that in the cases where the HoH were females the households' financial resources were limited (INE *et al.*, 2005). This is in concordance with the results in the present study, which although not as conclusive because not all respondents disclosed of their earnings, amongst those that did so female HoH tended to report much lower salaries compared to males. It has also been held that female-headed households are more prone to having children in poor health (Berman *et al.*, 1994), which suggests that the considerable proportion of female-headed households found in this study population might have implications in explaining the differences in the behaviour outcomes of interest in this study, which were *a priori* thought to be wealth-related.

A large percentage of the study participants was educated, (80% of HoH and 71% of principal caretakers), the majority with a lower primary education level (4 years or less). These figures do not reflect the country's overall education status figures due to the great disparity in education levels across regions and age groups. National figures indicate a literacy rate of 47% among adults. However there are Northern provinces where literacy rates get to as low as 23% (UNDP, 2002). In the province of Maputo, to which the district of Manhiça belongs, 67% of the adult population is officially literate.

The high education levels reported in this study, especially among caretakers, can chiefly be due to the fact that the target group comprised a young generation of people (mean age of 30), whereas most of the illiterate population across the country falls within the older age groups. A recent survey demonstrated that while the average education attainment among women 15-19 years was 3.3 years, it was zero in women aged 45 and above (INE *et al.*, 2005). In the present study, the average number of years of education among caretakers was 3.

Although girls still face barriers to go to school in Mozambique, there are strong aspects in the social and political context of the country that are in favour of girls' education being commonplace, therefore amongst women education attendance is no longer a marker of exceptional attributes. For example, throughout the past administrations, universal primary education, literacy campaigns and education for women and girls have been strong components of the political discourse, as Mozambique stands on a tradition of a struggle for equality and emancipation of women that went hand in hand with the struggle for liberation (from the 1960s until the 1970s) and the post-colonial reconstruction period (UNDP, 2002). Indeed, by 2000, gross enrolment rate had reached 91%. In addition, an average girl who started school could expect to complete 4.4 grades and an average boy 4.9, but only 6% would complete the whole 12 grade school cycle (Wils *et al.*, 2001).

There is however an indication that the education levels currently achieved often do not sustain literacy. These data support this indication, as only 72% of HoH and 49% of principal caretakers declared that they were able to read minimally.

The fact that the median number of householders was 6, paired with the fact that in majority of cases the HoH was the father of the index child, suggests that these households have had the tendency to depart from the large extended families reported to be the case in most rural Africa. Also it was seen from the data that children living in non-nuclear families were mostly likely to be living with their maternal rather than paternal family. This suggests that when mothers move into their new families, they are likely to continue living in close vicinity with their in-laws, as dictated by the norms of the patrilocal cultures, but not necessarily in the same compound, whereas when they remain in their own families they are more likely to remain in the same compound as their parents. This finding might have implications for explaining decision-making processes operating in the households regarding the preservation of health of the index child in general and the choice and use of HHEH products in particular.

Also related to household composition, the finding that the median number of children under 5 in the surveyed households was 2 reinforces that attention should be paid to child stool disposal practices in the domestic environments of this setting, in line with the argument that unsafely disposed of children's stools might not constitute a risk to diarrhoeal disease transmission to the same child but to other children in the same household (Lanata *et al.*, 1998).

In the chapter that follows, the variables described in this study that are related to wealth and social status (e.g., education, occupation, salary status, possession of valuable goods, and infrastructure) are combined to form composite variables that measure latent dimensions that characterise households. Such variables are applied in further analysis, serving as factors potentially associated with key environmental health practices that the study sought to investigate.

Chapter 6 Factor analysis of social and economic variables

Chapter summary

This chapter is organised in 4 sections. The introduction provides a justification for the use of factor analysis to serve the purpose of creating scales to measure wealth and women's autonomy. The methods section gives an account of the variables used for this analysis, discussing the rationale for using such variables, and details the procedures followed to obtain the scales. The methods section is followed by the results sections, which present the structures of the scales obtained, and the investigation on the adequacy of the data set to undergo factor analysis. The 4th section discusses and interprets the structures of the factors obtained, highlighting the usefulness of this exercise for the subsequent data analysis in the thesis.

6.1 Introduction

It was one objective of this study to explore relationships between HHEH practices and autonomy of women because the existing literature offers plausible suggestions for the role of women's autonomy in predicting health-related behaviours (Castle, 1993; Hakim *et al.*, 2003; Halvorson, 2004; Sallee, 2001). The present study also sought to investigate relationships between HHEH practices and wealth, based on the suggestion that wealth enables the acquisition, hence the utilisation of hygiene, sanitation (Armar-Klemesu *et al.*, 2000; Curtis *et al.*, 1995; Gorter *et al.*, 1998; Tumwine *et al.*, 2003), and mosquito

deterrence products (D'Alessandro *et al.*, 1994; Howard *et al.*, 2003; Macintyre *et al.*, 2002; Nuwaha, 2001; Ziba *et al.*, 1994) to preserve HHEH.

Autonomy is not directly observable and no single questionnaire item has been devised capable of generating a variable directly measuring "level of autonomy". Therefore, like most complex social sciences variables, various items should be required to measure it (Bernard, 1995). Likewise, there is increasing consensus that the measurement of "wealth" requires information on multiple attributes because although one such attribute might be able to capture one aspect of wealth, none of them in isolation can capture the complexity of this concept (Bernard, 1995). Hence there was a need for a suitable approach enabling the transformation of several directly measurable variables into "autonomy" and "wealth" scales, on which households could be rated and compared. This is what factor analysis allows (Rummel 1970).

The cumulative index is another such approach, which consists in adding up equally-weighted items of a scale to obtain scores which are assigned to participants. This technique was used by Sallee (2001) in order to obtain a scale on women's power from Indian data. The limitations of this approach are: (i) it assumes that the final scale is unidimensional and all items are interrelated; (ii) it does not distinguish *which* items in the scale contribute to the final score given to each subject (Bernard, 1995) - therefore different participants could have similar scores on one scale but be endowed with completely different sets of characteristics, resulting in rankings not reflecting the dimensions intended to measure; (iii) through this approach it is not possible to identify unnecessary items in the scale which are either redundant (i.e., measuring the same dimensions as other items) or unrelated to the scale.

Factor analysis was believed to be appropriate for the purposes of this study. It is a multivariate analysis technique applied to a set of variables, that the investigator suspects are interrelated, in order to determine which variables within the set interrelate to form coherent subsets (Rummel, 1970; Tabachnick & Fidell, 1996), each measuring one dimension of complex constructs. Each subset appears as a factor and is assumed to be independent from the others (Rummel

1970). Essential to the principle of factor analysis is the assumption that the subsets of variables interrelate due to the effects of underlying dimensions (Rummel, 1970). Factor analysis is also applied for the purposes of data reduction when there is a need to simplify complex sets of data (Foster, 2001). These two uses of factor analysis, namely identification of groups of inter-related variables and reduction of number of variables in a data set, often overlap (Rummel, 1970)

Factor analysis has been extensively used in many disciplines, particularly psychometrics (Afifi & Clark, 1984), mainly in the development of scales to measure complex constructs such as intelligence and personality. Additional examples of scales developed through this approach include self-esteem (Heatherton & Polivy, 1991) and family violence (Handwerker, 1994). DHS has recently embarked in the use of Principal Components Analysis (a variation of factor analysis) to calculate wealth indexes in developing countries (e.g., INE *et al.*, 2005). This approach has been successfully used for similar purposes to the present study, for example in the study of the association between socio-economic status and bednet ownership in Afghanistan (Howard *et al.*, 2003), and the study of socially constructed drives and constraints associated with latrine adoption in Benin (Jenkins, 1999).

The specific objectives of factor analysis in this study were:

- Establish correlations amid single variables from the survey data in order to obtain separate unidimensional indicators that together measure multidimensional qualities of the principal caretakers reflecting their autonomy and decision-making power within the household
- In the same way, obtain unidimensional indicators measuring multidimensional characteristics of the households reflecting their level of wealth
- Rate households and caretakers according to their level of wealth and autonomy, respectively

6.2 Methods

6.2.1 Measurement of wealth variables

The variables measuring wealth were derived from specific questions in the socio-economic and demographic questionnaire (shown in Appendix 6 and discussed in Chapter 4, section 4.5.1). From section B, information on HoH details was obtained, and from section G, indicators for living standards were generated. Spot-check observation (shown in appendix 8 and described in section 4.5.3) was used to collect data from which the variables measuring type of house were derived.

Two dimensions of wealth were expected to emerge namely *educational and occupational prestige of the HoH*, and *Household asset index*.

With regards to educational and occupational prestige, as seen in tables 3-3 through 3-6 (Chapter 3) indicators typically used in studies on socio-economic determinants of HHEH aspects, have been the occupation of key householders, especially the head of household, or the father, and to a lesser extent the mother. Still related to occupation, income is also a common indicator. However, cash income is seen as not the most important household feature predicting ability to pay for health care (Russell, 1996). This can be also true to the ability to acquire HHEH products. Further, due to response and recall biases, it is more difficult to collect reliable, detailed data on householders' incomes and expenditure.

Wealth is usually calculated using measures of education and occupational prestige (Bernard, 1995; Smith *et al.*, 1998). In their investigation of inequalities in child mortality in Mozambique, father's education gave a good reflection of the entire family's social standing (Macassa *et al.*, 2003). Moreover, in Mozambique, female-headed households are considered of low socio-economic status (UNDP, 2002), therefore HoH sex can be an important candidate indicator of wealth. This variable has been regarded an important

determinant of child health investments, such as caloric inputs in Jamaica (Handa, 1996) and hygiene index scores (Armar-Klemesu *et al.*, 2000).

However, as has been argued that social and economic stratification might take other forms in developing countries, ideally the measurement of wealth would not only include education, occupation, and income, but also land possession, housing conditions, and possession of valuable goods (Macassa *et al.*, 2003). This is where HH asset index becomes important. DHS's standard of living index includes housing type (floor type), infrastructure (e.g., toilet facility, source of electricity, source of drinking water), house ownership, and possession of agricultural land, livestock, and a number valuable goods (e.g., INE *et al.*, 2005). The valuable goods in the Mozambique DHS are car, motorcycle, fridge, telephone, television and radio.

More recently, asset indices have been gaining currency on the grounds that because they comprise a combination of variables, the possibility of capturing meaningful dimensions of poverty or wealth is increased, which might otherwise be missed if one or two individual assets are used as explanatory variables (Howard *et al.*, 2003).

There is the criticism that empirical studies on economic inequalities in aspects of health use dissimilar measures of economic status, from income through to consumption, assets possession, and occupation (Lindelov, 2006), and results might be sensitive to the type of economic indicator chosen. While a comparative analysis of 19 countries suggested that the type of indicator chosen had little effect on influencing the studies' results, Lindelov's study using Mozambican DHS data suggested that, compared to consumption indicators, asset indices overestimated households' wealth, due to the contribution of variables related to public infrastructure. Therefore care should be taken in interpretation of wealth indicators when in such indicators assets of the public domain, such as access to electricity, and type of water source, are mixed with private assets, such as ownership of radios, TV sets, livestock and land.

Having discussed potential problems that might arise from the choice of inappropriate measurements of household level wealth, it is concluded that: (i)

less criticism exists against the use of wealth indices; (ii) it is important to take into account economic status of female adult householders, with particular emphasis on wives, mothers and caretakers; (iii) assets should be those within the private domain of households.

The following variables were used as candidates for the wealth scales:

a) HoH schooling level

This corresponded to the highest level of education attained by the HoH and originally recorded in terms of the final grade (in years) completed. Due to the fact that literacy campaigns have been and still are in some rural areas the only point of contact with a formal education system, especially among women, attendance of adult literacy classes and number of years of attendance was recorded in addition to formal education. The variable was coded as the following 4 categories: "No education", "Adult literacy classes", "Lower-primary"²², "Upper-primary", and "Secondary".

b) HoH occupation

This variable was collected and entered as an open question and coded prior to data analysis into seven categories. "Unemployed" was assigned to those not working, including the retired but not including subsistence workers. "Subsistence workers" were unwaged cultivators or fishermen. "Vendors" included those that sold their produce, brewers, craftsmen selling their products, and those that resold manufactured products in the markets or streets. "Labourers" were waged cultivators, either working for the sugar cane industry or for privately owned fields, or those engaged in unskilled activities such as bricklaying. "Skilled workers" were those with a profession requiring some form of training, such as drivers, mechanics, soldiers, and machine

²² The National education system in Mozambique has 3 levels. The primary level (designed for children 6-12 years of age) has two cycles: "lower primary", from grade 1 to 5, and "upper primary", from 6 to 7 grades. The secondary level goes from grades 8 to 12, and it is designed for students 13 to 17 years of age. Following this level is higher education (INE 2005). None of the study participants had reached the latter educational level.

operators in the sugar factory. "Migrant labourers" were a very specific group of people with relatively low levels of education but high salaries from jobs (mostly mining) in South Africa. Finally the "Educated elite" comprised those with white-collar jobs (e.g., teachers, nurses, clerks, policemen, and laboratory technicians).

c) HoH income status

This variable was opted over the amount of money earned because a great proportion of respondents refused to disclose of their income (see Chapter 5). A variation of this variable has been used elsewhere in the context of a HHEH investigation (Curtis *et al.*, 1995). Curtis divided father's economic activity into "Salaried", "Irregular" and "Cultivator".

In the present study, the variable measured both whether the HoH had an income and if yes whether it was a fixed amount every month (which is the standard salary regularity in Mozambique). The variable had 3 categories: "None" was assigned to unwaged people such as the unemployed and the subsistence farmers. It should be noted that having these employment statuses did not automatically imply not having a salary; therefore this question was asked irrespective of the earlier mentioned occupation. "Irregular" was assigned to those that did not have a fixed income every month and "Regular" was assigned those that had a salary every month.

d) HoH sex

Two self-explanatory categories comprised this variable.

e) Total value of livestock owned

Rather than enquiring whether livestock was owned (which is what DHS uses) the total value of livestock owned was calculated in order to standardise the variable into a single unit of measurement.

After obtaining information on the types and numbers of all livestock currently owned by any householder, which included poultry, goats, cattle, and

pigs, the total value of livestock was calculated as the number of animals multiplied by the value (in MZM) of each of those animals. The total value of the livestock owned was inferred from the current price of those animals in the local market at the time of the survey, and divided into 4 categories, the lowest being "zero" (for those with no livestock). The higher categories were "Low", "High", and "Very high", which were demarcated by equally distanced cut-off points.

f) Location of water source

Households were classified according to whether their water source was their own ("In house"), "In neighbouring house" or "Public".

g) Type of floor in the main construction

Data on floor-type was in relation to inside of the main construction (the building where usually the HoH slept, or where the majority of the valuable goods are stored). "Dirt floor" was assigned to those made of earth, mud or dung, and "Cement" floors were those paved.

Although in most houses it was expected that the most expensive materials were to go to the main construction, there were houses where such materials were found elsewhere. After a thorough check, if the later was the case, the best materials in the house were recorded.

h) Type of walls in the main construction

Bricked walls, surrogated iron, or concrete walls were labelled as "Cement/zinc", reeds with no lining were labelled "Bare reeds", and reeds lined with mud or cement were designated "Reeds daubed with mud/cement".

i) Type of roof in the main construction

The type of roof was either surrogated iron sheets or cement (which was designated "Cement/zinc", or thatched with palm tree leaves, reeds or straw (which was labelled "Thatched").

j) Ownership of valuable goods

The living standard index used in the latest Mozambican survey (INE *et al.*, 2005), included the following variables on which the valuable goods of interest to this study were based: telephone, radio, television, refrigerator, car, motorcycle, and bicycle. Refrigerators and telephones were not included because in piloting this technique they were found to be too rare amongst the study population. A new item (iron) was incorporated, and car and motorcycle, together with backhoe ownership, were merged into one variable named "Motorised vehicle".

Two possible categories ("Yes" and "No") were assigned to each of the 5 variables selected, each regarding one valuable asset (see Table 6-1). For each variable, households had to have the respective good and in working conditions in order to be assigned "Yes".

k) Ownership of cultivation land

This variable had two alternatives: "Yes" meaning that at least one householder had their own piece of land for cultivation.

Ownership of cultivation land was thought more appropriate than ownership of property. The latter variable was thought not informative, thus was not considered for the wealth index because most rural Mozambican households (97%) live in houses that belong to themselves (INE, 2001).

Table 6-1 Set of candidate variables for factor analysis of household wealth

Variable	Category	Frequency (%)
Ownership of radio ^b	Yes	242 (60)
Ownership of bicycle ^b	Yes	56 (14)
Ownership of iron ^b	Yes	202 (50)
Ownership of television set ^b	Yes	53 (13)
Ownership of motorized vehicle ^b	Yes	27 (7)
Ownership of cultivation field ^b	Yes	321 (79)
Type of floor in the main construction ^a	Cement	222 (55)
	Dirt	142 (35)
	Missing	41 (10)
Type of walls in the main construction ^a	Cement / zinc	79 (20)
	Reeds daubed with mud/cement	137 (34)
	Bare reeds	188 (46)
Type of roof in the main construction	Zinc/cement	378 (93)
	Thatched	26 (6)
	Missing	1 (0)
Value of livestock owned ^b	Very high	64 (16)
	High	71 (18)
	Low	87 (21)
	Zero	183 (45)
Location of main water source ^b	In house	50 (12)
	Neighbouring house	211 (52)
	Public	144 (36)
HoH schooling level ^b	Secondary	66 (16)
	Upper primary	57 (14)
	Lower primary	201 (50)
	None	79 (20)
	Unknown	2 (1)
HoH occupation ^b	White collar job	60 (15)
	Migrant labourer	39 (10)
	Skilled activity	56 (14)
	Labourer	46 (11)
	Vendor	66 (16)
	Subsistence worker	113 (28)
	Unemployed	25 (6)
	Missing	1 (0)
HoH salary type ^b	Regular	222 (55)
	Irregular	101 (25)
	None	71 (18)
	Missing	11 (3)
HoH sex ^b	Male	323 (80)

^a Data source: spot-check observation

^b Data source: socio-economic and demographic questionnaire

6.2.2 Measurement of Caretaker's attributes

In the present study, 4 dimensions of women's autonomy were expected to emerge, namely *decision-making power*, *level of authority in the family*, *financial autonomy*, and *exposure to the wider world*.

Related to *decision-making power*, it was suggested that data on women's level of participation in decisions about domestic affairs (e.g., cooking, purchases, and treatment seeking options) should be rich enough to contribute to a relatively direct measure of autonomy (Hakim *et al.*, 2003; Sallee, 2001). In addition, education was considered as another indicator to contribute to the decision-making power and authority scales because educated women were seen to have the motivation and/or ability to exert more power over health choices compared to the less educated (Caldwell, 1979; Lindenbaum *et al.*, 1989; Sallee, 2001).

With regard to *level of authority*, the relationship with the head of household gives an indication of the woman's hierarchical position within the household, hence her level of authority. Moreover, her hierarchical position increases with age, marital and reproductive history. Castle (1993) has found hierarchical differences, given by those indicators, to be important predictors of treatment seeking behaviours in rural Mali. In the same setting women living in their own family had more authority than their sisters in law because daughters were expected to perform their household chores out of respect for their mothers whereas daughters in law were expected to do the same jobs out of obligation (Castle, 1993). In addition, rejection of domestic abuse was suggested to give indication of increased control over self, and courage to face prominent householders, as domestic violence towards females is considered a visible output of their subordinate role within the household (UNDP, 2002).

Regarding *financial autonomy*, this variable was believed important following the criticism that studies investigating the role of wealth tend to view household wealth as a homogeneous feature, failing to tease apart distinct and important levels of wealth within households. Pfeifer (2001) has emphasised the importance of looking at the amount of the spouses' salary women could get

hold of grounded on mounting evidence that men and women within the household have conflicting priorities for investment of household funds (Coreil, 1983; Russell, 1996), and that income in the hands of women is more frequently spent on more or higher quality food which children benefit from. For example in Egypt it was shown that when it came to deciding upon how to spend the meagre returns from their economic activities, women spend it on their children rather than on themselves (Katcha & Watts, 2002). The variables measuring financial autonomy of women address this issue. Degree of control over financial resources was proposed to reflect the level of autonomy influencing women's ability to manage their household health environment in Pakistan (Halvorson, 2004). In Mozambique it has been registered that control over own resources varies with women's marital situation and according to the proportion of their contribution to the household pooled income (INE *et al.*, 2005). On the other hand, irrespective of their own earning capacity, women were demonstrated to have different degrees of access to other people's money, for example their husbands' (Pfeiffer *et al.*, 2001). Therefore not only their occupation and formal wages were important indicators for this variable, but also other forms of access to or accumulation of cash such as participation in credit and savings schemes and receipt of stipends from family members. Education might also contribute to this variable.

Finally, regular exposure to mass communication channels has been interpreted as related of improved women's autonomy (Sallee, 2001). Exposure to information through media channels is thought to increase the predisposition to experimentation with new ideas, which can all be beneficial to child health.

The variables measuring caretakers' autonomy were obtained partly from the socio-economic and demographic questionnaire and from the questionnaire on women's autonomy (Chapter 4, section 4.5.2 and Appendix 7). It should be noted that not only the principal caretaker (the self identified caretaker in the survey questionnaire), was seen supervising the child, but also others, which were called secondary caretakers. The candidate variables for the

factor analysis on women's autonomy are presented in Table 6-1 and the operational definitions of the variables are given as follows.

a) Caretaker's schooling level

The level of education of the caretaker was defined in the same manner as that of the HoH (see section 6. 2. 1)

b) Caretaker's ability to read

This information was obtained by asking whether they were able to read on their own or they usually asked for information to be read out to them (for example the Bible, or pamphlets from the health posts). The category "Yes" or "No" was assigned based on caretakers answer.

c) Caretaker's ability to write

Ability to write was obtained from the informed consent sheet, where the caretaker had to write "I accept to participate" and sign her name. Women who could not write opted to mark the space with a cross or a fingerprint (Appendix 5).

d) Caretaker's Portuguese fluency

To obtain this information, caretakers were simply asked if they would be able to communicate in Portuguese should they have been required to, for example on a trip to Maputo. The category "Yes" or "No" was assigned based on caretakers answer.

e) Caretaker's occupation

This variable was obtained in the same way as HoH occupation (see section 6. 2. 1).

f) *Caretaker's income status*

This variable was obtained in the same way as HoH income status (see section 6.2.1).

g) *Caretaker's membership of xitique scheme*

Xitique is a rotating savings and credit association, a traditional form of mutual assistance among women (UNDP, 2002). Women participating in a *Xitique* group periodically contribute a fixed amount of money into a kitty, which is assigned in turn to each member. Caretakers were asked whether at the present they were members of any such association, and the possible categories were "Yes" or "No".

h) *Caretaker's access to money*

This variable had 4 categories: Caretakers that were earners and decided for themselves on what to do with their own money were categorised "Freely manages own money". Caretakers "Freely managing others' money" were those that although not earning, were regularly given an amount of money, like a stipend, from their husbands or other householders, and decided for themselves how to use the money. Those that were given money under instructions on what to do with the money, or those that had to ask for money every time they needed it for specific reasons were classified as "Restricted access to money". Finally those that never dealt with money were assigned to "No access to money".

i) *Caretaker's marital status*

Three categories comprised this variable. Caretakers were "Married" not only if in a civil, traditional, or religious marriage, but also if living informally with a partner. "Unsteady" were those in a relationship but had not yet moved in together. "No partner" was assigned to widows, separated, and other people not involved in a relationship.

j) Caretaker's acceptance of domestic violence

Caretakers were asked whether they believed that their husbands or in-laws had the right to beat them up if they had failed to cook properly, were neglectful in relation to child care-taking or other domestic chores, arrived home late, or went out without giving notice to anyone. Three possible responses were pre-coded: "Yes", "No" or "Indifferent" to those that were neither in favour nor against.

k) Caretaker's proximity to own family

This variable was obtained by asking the caretakers where their immediate relatives (parents, brothers and sisters) lived. The variable had 3 categories: "Same neighbourhood" referred to those living in the same house as their relatives', a neighbouring house or a house within the same *bairro* (see definition of *bairro* in Chapter 4). "Different *bairro*" was assigned to those not living in the same *bairro* but living in the district to Manhica, therefore regular contact with them was still expected, but not as regular as in the first option. "Outside Manhica" was in the case the immediate relatives did not live in the same district, but this also applied to deceased members.

l) Caretaker's decision-making power

Four different scenarios gave rise to one variable each, namely decision over the menus for the daily meals, decision over purchase of her own belongings (e.g., clothes), decision over treatment seeking option in the event of index child's illness, and of her own illness. The question sought to find out *who* in the household normally had the final word.

All decision-making power variables had the same possible outcomes. "Mostly caretaker" if according to her she took the final decision over the problem to be solved or she did not need to consult with anyone in the household. "Caretaker half the time" was when she considered that the situation varied from time to time, where roughly she had power over the final decision in equally the same proportions as other people in the household.

"Mostly husband or blood relatives" was assigned to those reporting that they did not take part in the final decision most of the time and that their husbands or parents did so. "Mostly in-laws or distant relatives" was for those who similar to the latter option did not take part most of the time in the final decision, but the people taking those decisions were more distant to her.

m) Caretaker's relationship with the HoH

There were 4 categories for this variable: "Self" if the caretaker was the HoH herself, "Spouse/partner" if there was a marital relationship between the caretaker and the HoH, "Blood relatives" if the HoH was her mother, father, grandparents or siblings, and "In-laws or others" if the HoH were her partner's relatives or other people not related to her.

n) Caretaker's exposure to information

Caretaker's exposure to information was regarding 3 communication channels. Specifically they were asked if they watched television at least once a week and if they listened to the radio at least once a week. This was irrespective of whether their households owned a radio or a TV set. The recall period for having read newspapers or magazines was longer (6 months) because it was expected that these events would be rarer. Each of these 3 variables had two possible categories: "Yes" or "No".

Table 6-2: Set of candidate variables for factor analysis of caretakers' attributes

Variable	Category	Frequency (%)
Final decision-maker on treatment to seek when the index child is ill ^a	Mostly Ct	243 (60)
	Ct half the time	22 (5)
	Mostly husband or blood relatives	122 (30)
	Mostly in-laws or distant relatives	18 (4)
Final decision-maker on treatment to seek when caretaker is ill ^a	Mostly Ct	213 (53)
	Ct half the time	10 (3)
	Mostly husband or blood relatives	163 (40)
	Mostly in-laws or distant relatives	19 (5)
Final decision-maker on food purchases on a daily basis ^a	Mostly Ct	226 (56)
	Ct half the time	33 (8)
	Mostly husband or blood relatives	126 (31)
	Mostly in-laws or distant relatives	20 (5)
Final decision-maker on where and when to buy Ct's possessions (e.g., clothing) ^a	Mostly Ct	221 (55)
	Ct half the time	17 (4)
	Mostly husband or blood relatives	163 (40)
	Mostly in-laws or distant relatives	4 (1)
Residence of Ct's immediate relatives ^a	Same neighbourhood	128 (32)
	Another neighbourhood	151 (37)
	Outside Manhiça or deceased	126 (31)
Ct's access to money ^a	Freely manages own money	169 (42)
	Freely manages others' money	195 (48)
	Restricted access to money	35 (9)
	No access to money	6 (2)
Ct's acceptance of domestic violence ^a	Violence not accepted	123 (30)
	Indifferent	31 (8)
	Violence accepted	251 (62)
Ct watches television ^a	Yes	114 (28)
Ct reads newspapers ^a	Yes	57 (14)
Ct listens to the radio ^a	Yes	313 (77)
Ct ability to read ^b	Yes	196 (48)
	Missing	1 (0)
Ct ability to write ^b	Yes	274 (68)
Ct participates in <i>xitique</i> scheme ^b	Yes	78 (19)
Ct's schooling level ^b	Secondary	31 (8)
	Upper primary	74 (18)
	Lower primary	182 (45)
	Adult literacy classes	10 (3)
	None	108 (27)

^a Data source: autonomy and decision-making power questionnaire

^b Data source: socio-economic and demographic questionnaire

Table 6-2 (continued)

Variable	Category	Frequency (%)
Ct's occupation ^b	White collar job	5 (1)
	Skilled activity	8 (2)
	Labourer	66 (17)
	Vendor/Trader	113 (28)
	Subsistence farmer	95 (23)
	Housewife/unemployed	118 (29)
Ct income status ^b	Regular	71 (17)
	Irregular	120 (30)
	None	213 (53)
Ct's marital status ^b	Married	270 (67)
	Unsteady	82 (20)
	No partner	53 (13)
Ct relationship with HoH ^b	Self	47 (12)
	Partner/spouse	230 (57)
	Blood relative	76 (19)
	In-law/other	52 (13)
Ct speaks Portuguese ^b	Yes	132 (33)

a Data source: autonomy and decision-making power questionnaire

b Data source: socio-economic and demographic questionnaire

6.2.3 Data analysis

Below are the steps that were followed in the factor analysis process:

- The categories on all candidate variables for the analysis were ranked from the hypothetically most privileged position of autonomy or wealth to the least privileged (as shown in tables 6-1 and 6-2).
- The candidate variables, categorised as described in a), were imported to SPSS 12.0 (SPSS Inc., 2003) from STATA 8.0 (StataCorp, 1984-2006).
- Analysis of caretaker's autonomy²³ and household wealth were conducted separately.
- In each analysis, the candidate variables were fitted in an unrotated Principal component analysis (PCA) model, which gave a feel for the data.

²³ Two sets of candidate variables were used to analyse caretaker's autonomy. One set was of information obtained from the principal caretaker (the one that was initially elected for the survey). The other set was of information obtained from the caretakers that were observed carrying out the behaviours of interest to the study (e.g., all people observed handling children's faeces, irrespective of whether they were the principal caretakers). These were called "secondary caretakers".

- e) The model assumes that each variable is correspondent to 1 factor, therefore the default number of factors was initially the number of variables in the model.
- f) The first step in the analysis was to inspect the eigenvalues, which are equivalent to the percent of variance attributable to each component or factor. The initial number of candidate factors is equivalent to the number of candidate variables inputted in the model.
- g) The total variance explained by the factors was inspected. Only the factors with an eigenvalue above 1 count for the total variance explained by the factors.
- h) A scree plot was used to dictate the number of factors to extract (Cattell, 1966). The scree plot is a graph of eigenvalues (Y-axis) against all candidate factors (X-axis) arranged in order of decreasing magnitude of their eigenvalues. Factors to the left of the inflexion point of the slope were retained (Cattell, 1966).
- i) After deciding on the number of factors to extract, the model was rerun with that number of factors. The most commonly used orthogonal rotation was conducted: the Varimax method. This step increases interpretability by making the correlations between the factors and the variables more visible than the weak correlations.
- j) Rotated PCA yielded a factor matrix indicating the correlations between each variable and each of the extracted factors. The parameter measuring such correlations was the factor loading. Loadings are the correlation coefficients between the variables and factors.
- k) A loading with an absolute value equal or greater than 0.30 was the cut off for inclusion of a variable in the interpretation of a factor (Foster, 2001).
- l) Variables that did not load on any factor as well as those that had loadings of similar magnitudes on more than one factor were dropped (Ferguson & Cox, 1993).
- m) Those that loaded highly on one factor and low on the other were maintained and the lower loading was ignored (Ferguson & Cox, 1993)

- n) In a step-wise fashion, new factor solutions were derived after eliminating such variables by following steps g) through m).
- o) If solutions were not easily interpretable (i.e., several cross-loaders and non-loaders), steps e) through to m) were repeated, this time using Principal Axis Factoring (PAF) (Foster, 2001).
- p) To test sampling adequacy, the Kaiser-Meyer-Olkin (KMO) test statistic was performed. The KMO should be greater than 0.5 and ideally close to 1 (Dziuban & Shirkey, 1974).
- q) The Bartlett test was carried out and the associated level of significance was obtained in order to ascertain that the data differed significantly from being an identity matrix. If that was the case it meant that the data were fit for factor analysis.
- r) Factors were interpreted and labelled by inspecting the content of the items that loaded most heavily on them.
- s) Scores on factors²⁴ were computed for each subject (household or caretaker) using the regression procedure. These are the scores that participants would have received on each factor, had the factors been measured directly.

6.3 Results

6.3.1 Factor analysis of wealth attributes

For this particular case, PAF was better-interpretable than PCA. Four components were suggested by the first extraction. However, 1 of them was not interpretable as a factor in the final PAF extraction, thus 3 factors constituted the final solution.

Table 6-3 shows the loadings for the 3 factors extracted. These factors together explained 31% of the total variance of the set.

²⁴ Factor scores are estimated through combining the intercorrelations among the original variables and factor loadings of those variables (Afifi & Clark 1984). Factor scores can quantify individual cases on a latent continuum using a z-score scale, which ranges from approximately -3.0 to +3.0 (ACITS, The University of Texas at Austin, 1995).

Thirteen out of the 15 candidate variables contributed to the final solution. One variable did not load on any factor and another variable loaded on two (double loading). These variables were “location of water source” and “type of roof of main construction”.

Table 6-3: Household wealth factors, extracted through PAF (Varimax rotation).

Factors and respective highly loading variables	Factor loadings
Factor 1:	
HoH occupation	0.81
HoH type of salary	0.74
HoH education	0.53
HoH sex	0.53
Factor 2:	
Type of wall	0.57
TV ownership	0.53
Type of floor	0.51
Iron ownership	0.45
Radio ownership	0.34
Motorized vehicle ownership	0.33
Bicycle ownership	0.30
Factor 3:	
Monetary value of livestock	0.53
Ownership of cultivation fields	0.35

6.3.2 Factor analysis of principal caretaker's attributes

The first extraction suggested 5 principal components.

PAF extraction revealed that the 5 factors explained 44% of the total variance of a 17 variable set. The loadings for these factors are shown in Table 6-4.

One variable, “Ct acceptance of domestic violence” did not load on any factor and cross loading of “Ct reads newspapers” was detected. These variables were removed from the model.

Table 6-4: Principal caretaker attributes factors, extracted through PAF (Varimax rotation).

Factor names and highly loading variables	Factor loadings
Factor 1:	
Ct's schooling level	0.84
Ct ability to read	0.78
Ct ability to write	0.82
Ct speaks Portuguese	0.33
Factor 2:	
Ct's income status	0.89
Ct occupation	0.75
Ct access to money	0.68
Membership in a <i>xitique</i> scheme	0.35
Factor 3:	
Ct decides on food purchases	0.66
Ct decides on treatment to seek when Ct is ill	0.59
Ct decides on purchases of personal belongings	0.54
Ct relationship with HoH	0.45
CT decides on treatment to seek when the index child is ill	0.39
Factor 4:	
Residence of caretaker's relatives	0.68
Ct marital status	-0.49
Factor 5:	
Regular contact with radio	0.56
Regular contact with TV	0.50

6.3.3 Factor analysis of secondary caretaker's attributes

Similarly to the analysis of principal caretakers attributes, 19 items constituted the candidate variables for this analysis.

The final extraction was set at 4 principal components as suggested, from its scree plot. The 4 principal components explained 51% of the total variance of a 14 variable set. The loadings for these principal components are shown in Table 6-5.

Two variables did not load on any factor and cross loading of 3 variables was detected. These variables, which were "decision-maker on treatment to seek when child is ill", "decision-maker on food purchases", "Ct's access to money", "Ct's relationship with HoH", and "Ct speaks Portuguese", were removed from the model.

Table 6-5: Secondary caretaker attributes factors, extracted through PAF (Varimax rotation).

Factor names and highly loading variables	Factor loadings
Factor 1:	
Ct's schooling level	0.90
Ct's ability to write	0.78
Ct's ability to read	0.77
Regular contact with written news	0.53
Regular contact with TV	0.48
Regular contact with the radio	0.41
Factor 2:	
Ct's income status	0.84
Ct's occupation	0.72
Membership in a <i>xitique</i> scheme	0.52
Factor 3:	
Ct decides on purchases of personal belongings	0.75
Ct attitude to domestic abuse	0.57
Factor 4:	
Residence of caretaker's relatives	0.83
Ct marital status	-0.58
CT decides on treatment to seek when the index child is ill	-0.39

6.3.4 Sampling adequacy

The measures of sample adequacy and multivariate normality of the set of distributions of the groups of variables that underwent factor analysis show that these data were fit to undergo factor analysis (Table 6-6).

From all the 3 sets of distributions of the final candidate variables, the KMO measure of sample adequacy was >0.7 , which is considered appropriate, as a minimum of 0.5 is required (Dziuban & Shirkey, 1974).

The Bartlett test, which measures multivariate normality of the set of distributions, showed a significant value of 0.000. It rejects the null hypothesis that no relationships exist between any of the variables.

Having had satisfactory results from both tests meant that it was possible to accept the extraction with confidence that the matrix derived from the data was appropriate for factor analysis (Ferguson & Cox, 1993).

Table 6-6: KMO and Bartlett's Test for the candidate set of data on household wealth

Variable set	Test	Test Statistic result	Significance
<i>Household wealth</i>	Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.75 *	-
	Bartlett's Test of Sphericity	$X^2 = 586.35$ d.f.=78	0.000
<i>Principal Ct's attributes</i>	Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.76 *	-
	Bartlett's Test of Sphericity	$X^2 = 1808.58$ d.f. = 136	0.000
<i>Secondary Ct's attributes</i>	Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.73 *	-
	Bartlett's Test of Sphericity	$X^2 = 614.79$ d.f. = 91	0.000

Note: * Keiser's scale is divided into 6 levels, from >0.9 (close to perfect correlation) to <0.5 (perfectly uncorrelated)

6.4 Factor interpretation and discussion

Factor analysis was applied to obtain scales for 2 dimensions of the household economic and social environment: household wealth and caretaker's autonomy.

A priori expectations existed as to the types of factors that would emerge. However, some variables which had earlier been posited to form part

of the scales were proved not useful items of the scales that the study sought to obtain. Therefore, based on existing literature, commonsense, and following the heuristics applied for factor interpretation (Ferguson & Cox, 1993), post-hoc explanations were developed for the new structures found.

Each of the 2 dimensions is discussed separately.

6.4.1 Household wealth

Instead of the two dimensions predicted, namely household occupational and education prestige, and household asset index, the factor analysis produced 3 dimensions of wealth, which were interpreted as follows.

Factor 1 suggests an element of social status reflected in the attributes of the head of household. The strongest variables explaining this factor were "occupation" and "income status". The other variables were "HoH sex" and "HoH education". This factor captures the classic components of socio-economic status which are chiefly determined by income, education, and occupational prestige (Bernard, 1995; Smith *et al.*, 1998). Therefore, factor 1 was designated *HoH socio-economic status*.

It is plausible that the above variables together measure the same trait. It can be argued that occupation is a strong social marker, as agricultural and vending jobs tend to belong to less disadvantaged social groups compared to the skilled and white-collar jobs. The type of salary enjoyed by the HoH may contribute to the level of economic stability in the entire household. Education level can equally be a marker of social status as, amongst other things, provides the skills for an occupation and the type of occupation has been argued to be an indication of prestige (Bernard, 1995; Smith *et al.*, 1998). In patrilinear and patrilocal societies such as the one under study, male-headed households are more likely to have a higher social and economic status compared to female-headed households.

The variables comprising Factor 2 express a palpable dimension of wealth, given by the visible accumulation of assets by the household. The strongest valuable goods loading on this factor were possession of TV set and

iron. This material dimension of wealth is characterized by assets that are available in the modern market. For example, improved houses require cement, which is considered a modern commodity. This factor was therefore named *accumulation of modern assets*.

Factor 3 indicates another dimension of material wealth that has to do with land ownership for agriculture, and the total value of livestock owned by the household. As seen in Chapter 5, livestock is mostly used for household subsistence and hardly sold. Although livestock can be a way of saving wealth, the acquisition or accumulation of these does not necessarily involve money. For example there is the practice of *khvekhelissa*, where the youngest, less wealthy people in the community look after others' livestock in exchange for new-born animals and in that way they can start accumulating their own livestock (UNDP, 2002). An analogous concept of wealth was registered amongst the Fula of the Gambia, who are mostly herdsman and their conception of wealth is around cattle, which are hardly sold for cash but used for social obligations of higher levels such as bride-price negotiations, and safeguarding of social status (Aikins *et al.*, 1993).

Similarly, the acquisition of land in rural Mozambique is mostly done through complex traditional processes, the understanding of which is beyond the scope of this study. It has been described as strongly associated with processes of bride price, entrustment by traditional authorities, and inheritance laws (UNDP, 2002).

Perhaps the essential traditional value of animals was not captured here, due to the way the questioning was done (e.g., there was no probing as to what else was done with the animals besides selling and consuming them). Nonetheless, it can be agreed that animal capital is a traditional form of asset.

The above-discussed composition of Factor 3 suggested that this factor be designated *household accumulation of traditional assets*.

In this setting, whilst the accumulated assets comprising Factor 2 reflect disposable income, livestock and land represent subsistence base.

6.4.2 Caretakers' autonomy

a) Principal caretaker

As presented in Table 6-4, Factor 1 combines high loadings from literacy and Portuguese fluency with schooling level, to suggest an *Educational status* factor which is not given solely by the number of years of education attended, but also by other intellectual attainments of the caretaker.

Factor 2 suggests a measure of *Caretaker's financial independence*, as it is marked by high loadings on her occupation and salary as well as indicators of other less formal personal resources.

All decision-making power variables as well as one item indicating caretaker's hierarchical position in the household were highly loaded on Factor 3. Given the nature of the loading variables of this factor, it was named *Decision-making power*.

Factor 4 was highly loaded on "Marital status" and "Residence of caretaker's relatives". However, this factor turned out to be bipolar, in that the higher the score on this factor the less stable her marital status was likely to be and the more likely it was for the caretaker to be living in the proximity of at least one immediate relative. The measures comprising this factor are intuitively alternative expressions of a single, underlying social situation. It means that this factor could actually be measuring caretaker's marital status, which in itself could be another dimension of social status, as suggested by UNDP (2002). On the other hand it could be giving an indication of the amount of support she is likely to receive from her immediate family. If that were true the most advantageous ones would be those that were still having support and advice from their mothers. This factor was named *Caretaker's proximity to own family*.

Factor 5 is related to watching TV and listening to the radio, giving an indication of *Exposure to information*, which could be indicative of exposure of the outside world, and exposure to new ideas.

The set of factors in the final solution did not differ markedly from the predicted structure in the sense that the presence of three main factors (*Financial autonomy*, *Decision-making power* and *Exposure to the outside world*) was shown. A single factor measuring level of authority in the household, which was predicted to load on "Attitude to violence", "Relationship with the HoH", "Marital status", and "Residence of immediate relatives" did not emerge. Instead, a specific measure of decision-making power emerged in which one dimension of authority took part. Finally, elements of education level, which were initially believed to contribute to the caretaker's *Decision-making power* and/or *Financial autonomy*, turned out to be measuring an independent dimension solely related to education.

b) Secondary caretaker

The factor structure of the secondary caretaker (Table 6-5) differed somewhat from that of the principal caretaker's (Table 6-4). This was principally due to the fact that in the group of secondary caretakers there were younger carers (siblings of the index children) and much older ones (maternal and paternal grandmothers). However, the analysis does not allow concluding a real difference between the structure of primary and secondary caretaker attributes.

Educational status of these caretakers merged with the variables of exposure to the media, to form Factor 1. This factor was therefore designated *Educational status and Exposure to information*. This unexpected clustering of items that were proposed to be measuring separate dimensions could also be due to noise in the data, since this questionnaire was specifically prepared to be administered to women of reproductive age.

The second factor was similar in structure to the principal caretaker's Factor 2. Therefore it was also named *Financial independence*.

Factor 3 had one item of decision-making power (over treatment-seeking choices following index child's illness), and two items of residence and marital status. This factor was bipolar whereby the decision making variable and the

marital status variable were positive loaders whereas the proximity to her family was a negative, but very strong loader. It meant that caretakers had more control over the children under care if living away from their family. This factor was still named *Proximity to caretaker's own family* due to the strength in the loading of the variable that gave this information.

Factor 4 was loaded by one decision making variable (on purchasing of caretaker's own belongings) and acceptance to violence. This factor gave an indication of how much other people were allowed control over herself and her dealings, therefore was called *Level of authority*.

In summary, this chapter gave a comprehensive account of the process through which single items of information obtained during the household survey were combined to form complex constructs characterizing levels of household wealth and caretakers' autonomy and decision-making power. Factor analysis was successfully used for this purpose.

There is still scepticism towards factor analysis, particularly from disciplines outside the social sciences, on grounds that researchers resort to it in order to save data from poorly conceived studies (Ferguson & Cox, 1993). However, it has been argued that if prior to data collection and analysis the researcher works out in detail the structure of the scales they expect to obtain then this approach is appropriate (Armstrong & Soelberg, 1968). Such was the case for the piece of research here presented. Although some variables were dropped, the general factor structures were as expected.

There were however some factors that surfaced in the dataset of the principal caretaker but did not in the secondary caretaker's dataset and vice versa. This shows that although the data comes from the same households, important differences exist between the principal caretakers (which are mostly mothers) and the secondary caretakers (which besides mothers also include people from other generations).

As argued by Tabachnick & Fidell (1996) factor scores are often more reliable than measurements on individual observed variables. These scores

were particularly useful because they served as data for further analysis. In this way the factors obtained constituted new independent variables.

As a step forward from this analysis, for each of the obtained factors, which were continuous variables, the data was split into quartiles and each household was assigned to a quarter according to the scores obtained in the factor analysis scores. Such grouping was said to discard information, but to be useful in that it allows simplification in displaying information (Altman & Bland, 1994). Quartiles were chosen over quintiles because the sample sizes predicted for further analysis were small to bear statistical analysis involving stratification into several categories.

The association between the obtained factors and selected environmental health practices was estimated, as presented in chapters 7 and 8.

Chapter 7 Hygiene and sanitation practices

Chapter summary

This chapter is organised in 5 sections: Following the introduction, which justifies the chosen hygiene and sanitation practices and predicting factors, it briefly outlines the methods used to collect and analyse the data presented in this chapter. This section gives attention to operational definitions of the outcome variables, and the analysis strategy.

Subsequently, the results section is presented, which looks firstly at possession and characteristics of latrines, followed by a description of patterns of stool removal practices. The following subsections are dedicated to the description of the yard organisation, including aspects of water collection and storage. It then explores the presence and use of facilities needed for hand-washing before describing patterns of hand hygiene practices after potential faecal contact. Next in the results section are the subsections devoted to further analysis of hand hygiene and stool disposal practices by exploration of factors associated with them.

Finally, the findings are discussed, leading to a conclusion and considerations of the implications of the results for hygiene promotion.

7.1 Introduction

The literature review, presented in Chapters 2 and 3, has set the grounds for this chapter in two ways. First, it established key hygiene and sanitation practices, within the framework of EH, which if they are performed adequately, constitute protective factors for the spread of diarrhoeal disease pathogens in

households. Second, it explored individual and household level variables that could predict the performance of these protective practices.

Despite some gaps in the existing evidence, chiefly due to study design limitations, the literature review gave indication that isolation of faecal material from the environment (Fewtrell *et al.*, 2005), hand-washing with soap after contact with faeces (Curtis & Cairncross, 2003; Fewtrell *et al.*, 2005), and preservation of the safety of water at the point of use (Fewtrell *et al.*, 2005) are important protective factors for diarrhoeal disease.

Although epidemiological studies have focused on prevalences of such protective practices, little information exists detailing, *in what frequency, where, when, how, by whom, and under which circumstances* the above practices occur at the level of the household. In certain populations, some of these practices have been described in detail, for example in Peru (Gilman *et al.*, 1993; Huttly *et al.*, 1994; Yeager *et al.*, 1999), Burkina Faso (Curtis *et al.*, 1995), Bangladesh (Hoque & Islam, 1995), Kyrgyzstan (Biran 2005), and the UK (Curtis *et al.*, 2003). However such descriptions cannot be generalised to other settings. The knowledge base of patterns of hygiene and sanitation practices for the population under investigation in this study is nonexistent.

Further, the current state of knowledge is incomplete, particularly in this population, regarding details of other practices and state of affairs, which although their relative importance in interrupting the routes of transmission of diarrhoea disease does not carry supportive evidence from the literature, they have been considered important elements of the concept of HHEH (Boot & Cairncross, 1993). One example is cleanliness of living areas, which may indirectly contribute towards removal of faecal material from the environment.

Regarding the second point addressed by the literature review, about variables that might explain differences in HHEH practices, the focus of this chapter is on the practices the importance of which has been backed by strong, consistent evidence. There was indication, from the pilot study, that household treatment of drinking water in this community is nonexistent, unlike reported in other settings (e.g., Gilman *et al.*, 1993), therefore the practices further

explored in this chapter are only those related to hand hygiene and stool disposal.

The literature pointed to conceivably plausible relationships between women's education and disease protective hygiene and sanitation practices (Lindenbaum *et al.*, 1989). However evidence for such associations, based on studies by direct observation, is scant and inconclusive. Only 2 studies were found that tested the association between observed hand-washing with soap after latrine use and woman's education, with discordant results (Gilman *et al.*, 1993; Gorter *et al.*, 1998; Hoque & Islam, 1995).

Evidence for the association between maternal education and safe stool disposal is also scant, weak, and inconclusive, mostly based on traces of behaviour such as ground or latrine area free of faeces (Curtis *et al.*, 1995; Gorter *et al.*, 1998; Tumwine *et al.*, 2003). Evidence based on direct observation comes from one study in Nicaragua (Gorter *et al.*, 1998), which suggested a positive, but not significant, association between safe stool disposal and increasing level of maternal education.

Besides education, women's financial independence, decision-making power, and hierarchical position in the family, have been shown to predict health behaviours other than hygiene and sanitation (Hakim *et al.*, 2003; Lindenbaum *et al.*, 1989; Sallee, 2001). The importance of these factors has not yet been empirically explored in the field of hygiene and sanitation.

Mixed results were found on the side of the role of wealth in predicting sanitation behaviours. While grounds clear of human faeces showed no association with wealth in Burkina Faso (Curtis *et al.*, 1995 109), the contrary was found in East Africa with regards to latrine slab free from faeces, after adjustments for the influence of other factors (Tumwine *et al.*, 2003).

Regarding hand hygiene and wealth, the existing results are also debatable. A link was seen between land ownership and hand-washing technique (Hoque & Islam, 1995). Conversely, no wealth variables predicted hand-washing practices after stool contact in Peru (Gilman *et al.*, 1993).

Contrary to the mixed results regarding education and wealth as predictors of single hygiene or sanitation practices, when practices were measured as composite variables, these outcomes consistently showed positive associations with wealth or women's education. However, the studies found on the subject were rare (Armar-Klemesu *et al.*, 2000; Barrett & Browne, 1996; Van Bortel *et al.*, 1996).

As regards to the relationship between hygiene and sanitation practices and environmental health variables, research from Burkina Faso and Bangladesh suggested that hand-washing with soap was partially determined by type or domain of water source (Curtis *et al.*, 1995; Hoque & Islam, 1995). Those results could either mean that improved access to water source was a convenience factor that facilitated engagement in water-involving hygiene practices, or that water source was a mere proxy wealth variable, implying that households with access to improved water sources were also likely to have soap for hand-washing hence more likely to follow the behaviour. Ownership of a tap as opposed to using public taps or wells, was also a predicting factor for behaviours that did not require the use of water, such as safe disposal of children's faeces (Curtis *et al.*, 1995). In a similar manner in Brazil, households with adequate sanitation facilities were more likely to engage in positive hygiene practices, including those not related to stool disposal (Strina *et al.*, 2003). This could mean the existence of underlying factors influencing use of better water and sanitation facilities, which were also operating in the improvement of hygiene practices.

Age, of the mother and the child, was suggested an important factor influencing practices related to child defecation in Burkina Faso (Curtis *et al.*, 1995). While there has been no other study confirming the role of maternal age, child's age showed a consistent relationship with defecation site arrangements and stool disposal in a literature review by Gil and colleagues (2004), which showed that as children got older defecation in open areas increased.

The present chapter addresses some of the gaps in knowledge discussed above, by:

- Detailing patterns of observable HHEH practices as well as availability of environmental health products related to the safe performance of those practices
- Exploring the relationship between key diarrhoeal disease protective practices and the above-discussed individual and household level characteristics.

Based on the existing evidence on factors influencing health related behaviours by caretakers of young children and the scant evidence pointing to factors influencing hygiene and sanitation in the homes, this chapter was guided on the hypotheses that follow (which are expressed in more detail in the conceptual framework displayed in Chapter 3, section 3. 4).

Latrine possession and soap possession by households is associated with the wealth of the household, caretaker's education, caretaker's decision-making power, caretaker's financial autonomy, and caretaker's exposure to information.

Yard free of excreta, sanitary disposal of children's stools and hand-washing after handling child's stools are associated with the all the above variables as well as with water source ownership, caretaker proximity to own family, caretaker's age, and the child's age.

7.2 Methods

7.2.1 Data collection

The methods used are detailed in Chapter 4. The chief method used to generate data for this chapter was structured observation (section 4. 5. 4), which allowed the systematic recording of sequences of behaviour related to open defecation by children and subsequent disposal of children's stools by caretakers, latrine use in the households and subsequent hand hygiene, and hand hygiene after contact with children's faeces.

Spot-check observations (section 4. 5. 3) provided information regarding traces of stool removal behaviours and environmental conditions connected to sanitation and water.

The socio-economic and demographic questionnaire (section 4. 5. 1) provided information regarding possession of or access to environmental health products relevant to hygiene and sanitation (latrine, soap, and source of drinking water). It was through this questionnaire and the women's autonomy questionnaire (section 4. 5. 2) that the explanatory variables for further analysis in this chapter were obtained.

7. 2. 2 Specification and measurement of outcome variables

This section provides precise, operational, working definitions of the behaviour outcomes on which data were collected.

a) Possession of functioning latrine

This variable had 3 possible categories ("Yes" / "No" / "Not observed"). A household was said to have a functioning latrine provided that:

- It was declared to be present and in functioning condition (i.e., not full nor damaged in such way that one would have not be able to use it at that moment).
- The observer visited the latrine and the observer would have been able to use it.

A household was considered not to have a functioning latrine if:

- The respondent declared absence of a latrine or presence of a non-functioning latrine.
- The latrine was present and was visited, but the observer could not have been able to use it.
- The latrine was reportedly present but found not to be within the yard.

If presence of latrine was declared but observer did not visit the latrine, and saw it from the outside then "Not observed" was assigned.

b) *Covering of the squatting hole*

This variable gave a binary outcome, where "Yes" was assigned to those that had the squatting holes completely covered with any device at the time, from the point of view of flies not being able to access or escape the hole.

c) *Cleanliness of the latrine*

Cleanliness of the latrine meant no visible faecal matter outside the pit, i.e., "Yes" meant no human faeces or any used anal cleansing materials spotted lying on the latrine floor or elsewhere on the slab, if not inside the pit itself.

d) *Type of slab*

This variable was collected as an open question, to allow the observer to describe the materials used for a slab. Those descriptions were recoded into 3 broad types: "Commercially available", for those slabs that are usually purchased (e.g., Sanplat), "Local materials" for those made of other materials, including recycled (e.g., car wheel hubs and ceramic bowls), and "No slab" for those latrines simply comprising an open pit.

e) *Yard clear of human faeces*

"Yes" was attributed to the instances where human faeces were not seen lying on the ground within the yard.

f) *Disposal of children's faeces*

There were 5 categories coded for this practice. "Floor", if the child had defecated on the floor and either stools were not removed, or they were moved into a corner or rubbish heap.

Faeces were considered "Wrapped in nappies or cloth" if the handler enclosed the stools in those materials which in turn were left on the floor, or in a basin presumably for further action which was not seen during the course of the observation. Stools were considered "Washed" when they were washed

along with the nappies or soiled clothing with no procedure to remove them from the soiled material first.

Stools were "Buried" when the handler dug a hole (irrespective of the depth), put them into the hole and covered it. If stools were just covered with sand, but still on the surface of the soil, or the hole was dug but not covered then "Floor" was the category assigned to this variable.

"Latrine" was assigned in the instances that the handler removed the stools from the defecation site and took them to the latrine.

For further analysis this variable was derived into a new binary variable "Safe disposal of child's stools", whereby "Yes" meant that they were buried or taken to a latrine. The alternative outcome comprised instances in which the child's faeces were left lying on the floor, wrapped in nappies (which in turn were neither disposed of nor washed during the course of the observation), swept or taken to a corner, or to an open rubbish heap.

g) Soap possession

Soap could be in any of the following forms: laundry bar, liquid, cosmetic, or powder. This variable had two possible, self-explanatory, categories ("Yes" / "No") regarding whether the respondent declared that any form of soap was available in the household at the time.

h) Hand-washing after handling children's stools

Any of the following events represented handling children's faeces: cleaning up the child after defecation, removing or changing the child's nappies after defecation, and disposing of child's nappies or stools. An individual was said to have "Rinsed the hands" after these events if, immediately after the event, they deliberately rinsed both hands without soap. If soap was used, then the category "Hand-washing with soap" was assigned. "Rinsed one hand" was the third category.

If for example the individual went on to carry out an activity involving water, for instance dishwashing or washing the child's bottom, this was not considered as hand-washing.

Because hand-washing with soap was rare, the hand-washing variable was recoded, where "hand-washing" was said to have occurred if the handler deliberately rinsed both hands immediately after the event, with or without soap.

i) Hand-washing after latrine use

Here the operational definition for the act of hand-washing was the same as the one after handling children's faeces (section 7.2.2).

j) Hand-washing frequency after all critical events

This new variable was derived from the above hand-washing variables. This variable was a proportion, where the numerator was all occasions where hand-washing was observed after a potentially critical event (handling children's faeces or visiting the latrine), and the denominator was the sum of all potentially critical events observed. This proportion was expressed on a percentage scale.

k) Water storage

The only aspect of water storage condition investigated was whether the observed vessels storing drinking water were protected with a cover or lid at the time (when the water was not in use). The categories for this variable were "Yes", when all observed vessels were covered, "Varied" if some were covered and others were not, "No", when none of the observed vessels were covered, and "Not observed" in case water storage vessels were not seen.

l) Type of Source of drinking water

Since more than one source was predicted to be mentioned, respondents were asked to identify, amongst the ones cited, the most frequently used for the

purpose of drinking, and that was taken as the main source. The categories for this variable were "Tap", "Well", "Pump" "Spring or river".

7.2.3 Data analysis

a) Descriptive analysis

A descriptive analysis gave the relative frequencies of the aforementioned variables. In order to have a detailed account of the forms in which risk and protective practices occurred, the categories in which behaviours were recorded were left intact for descriptive purposes.

Still for descriptive purposes, of those variables that were measured repeatedly, the categorical variables (with more than 2 categories) were expressed in terms of relative frequency of each category, having the repeated events in same households been treated as independent data points, for example, *observed child's defecation site* or *observed stool disposal behaviour*. On the other hand, binary variables were expressed in terms of proportions of occasions where the positive behaviour was observed "On all occasions", "Sometimes" and "Never", for example *latrine cleanliness* or *protection of water storage vessels*.

b) Univariate analysis

For the univariate analysis, outcomes from repeated measurements were expressed in terms of the proportion of occasions the condition of interest was observed, the denominator being the number of opportunities there were to observe the event throughout the observational visits. Variables were categorised into 2 categories, namely "Never" if proportion of occasions whereby that practice was observed = 0 and "Ever" if the proportion > 0.

The 5 following outcome variables underwent univariate analysis:

- *Latrine possession (Yes/No)*²⁵
- *Soap possession (Yes/No)*
- *Safe disposal of child's stools (Ever/Never)*
- *Yard clear of human faeces (Ever/Never)*
- *Hand-washing after handling child's stools (Ever/Never)*

For each of the above practices or conditions and their predicting factors, a univariate analysis was performed as follows. Stratum-specific odds ratios (OR), and 95% confidence intervals, of latrine possession, soap possession, ever safely disposing of child's faeces, ever having yard clear of human faeces, and ever washing hands after handling children's stools, was calculated. Mantel-Haenszel odds (M.H. odds) with their respective confidence intervals were computed in order to determine the trend of odds for each unit change in the values of the hypothesised exposure groups.

All associations between the predicting factors and the behaviour outcomes with a p value < 0.05 were considered statistically significant.

c) Multivariate analysis

Five logistic regression models were then run using the backward fitting approach. Each model included all variables showing crude association with one behaviour outcome, provided that interaction between them was predicted. The interactions explored were between wealth and education, education and exposure to information, wealth and exposure to information and wealth and water source domain. In a stepwise fashion, the variable showing the least correlation to the behaviour outcome was dropped from the model, and the analysis was rerun until all the factors in the model remained significantly correlated to the outcome.

²⁵ There is suggestion, from this study's data, that reported latrine ownership is a valid indicator, when compared to observed ownership. Therefore the analysis of latrine possession status made use of reported data, which offered a larger sample size.

d) Taking into account multiple actors in repeated measurements within one household

A different approach was used to analyse hand-washing and stool disposal behaviours in relation to child's and caretaker's attributes. This was because there were households where a single child was observed defecating more than once, and different caretakers handled the faeces on different events. There were also instances where different children accounted for different defecation episodes in single households.

Therefore, to investigate the influence of caretaker's and child's attributes on repeatedly measured hand-washing and stool disposal behaviours, the unit of analysis was a single defecation event²⁶, regardless of the household in which it had taken place.

Since it was expected that the stool handling and hand-washing behaviours following the event would be more correlated within households than across households, the analysis took into account the cluster effect at household level. This was done using a logistic regression model with generalised estimated equations (GEE), with a robust standard error. The results from this analysis were presented in separate tables (Table 7-7 and Table 7-9) from those presenting univariate and multivariate analysis for singly-measured outcomes (Table 7-6 and Table 7-8).

7.3 Results

7.3.1 Description of the hygiene and sanitation variables

a) Latrine possession and conditions

Ninety-five percent of the 405 surveyed households reported having a latrine installed within the household yard and in apparent use. In the sub-

²⁶ In the instances that, following the same defecation event, one caretaker was seen handling the child's stools and other was seen cleaning the child, then these were accounted as 2 separate events.

sample of houses where structured observation took place at least once (n=102), 95% of them had a functioning latrine by the last day of observation.

In terms of super structure, most latrines were enclosed in fragile walls for basic privacy. Most walls were made out of reeds, and in very few cases the superstructure was made out of nylon rice sacks or black plastic (Figure 7-1).

In the few latrines with no slab/seat the pit was visibly shallow. Owners of the remaining latrines described them as having an unlined single pit underneath the slab/seat. The only components of the latrine that showed marked variation were the type of slabs (Table 7-1), and latrine cleanliness (Table 7-2). This led to further classification of the latrine status. Data from spot-checks on the latrine revealed that most slabs/seats were made of local or recycled materials such as ceramic bowls (Figure 7-2), car wheel hubs, and wooden platforms.

Figure 7-1: Typical latrine superstructure



Figure 7-2: Types of slabs/seats. Car wheel hubs (a) and ceramic bowls (b) are amongst the most common material used.



Table 7-1: Type of slabs of the visited latrines

Type of slab/seat	Freq (%)
No slab	8 (9)
Local materials	75 (82)
Commercially available	9 (10)
Total	92 (100)

In terms of latrine conditions, as can be seen from Table 7-2, in 61% of households, latrine pits did not have a lid in place on any of the observed occasions. The latrine slab or floor was ever soiled with faeces in 33% of households.

Table 7-2: Observed latrine conditions

Share of occasions the condition was observed (n=92)	Number of households (Percentage)
Latrine pit with lid in place	
Never	56 (61)
Sometimes	15 (16)
All occasions	21 (23)
Latrine slab and floor free of faeces	
Never	14 (15)
Sometimes	16 (17)
All occasions	62 (67)

b) Disposal of children's stools

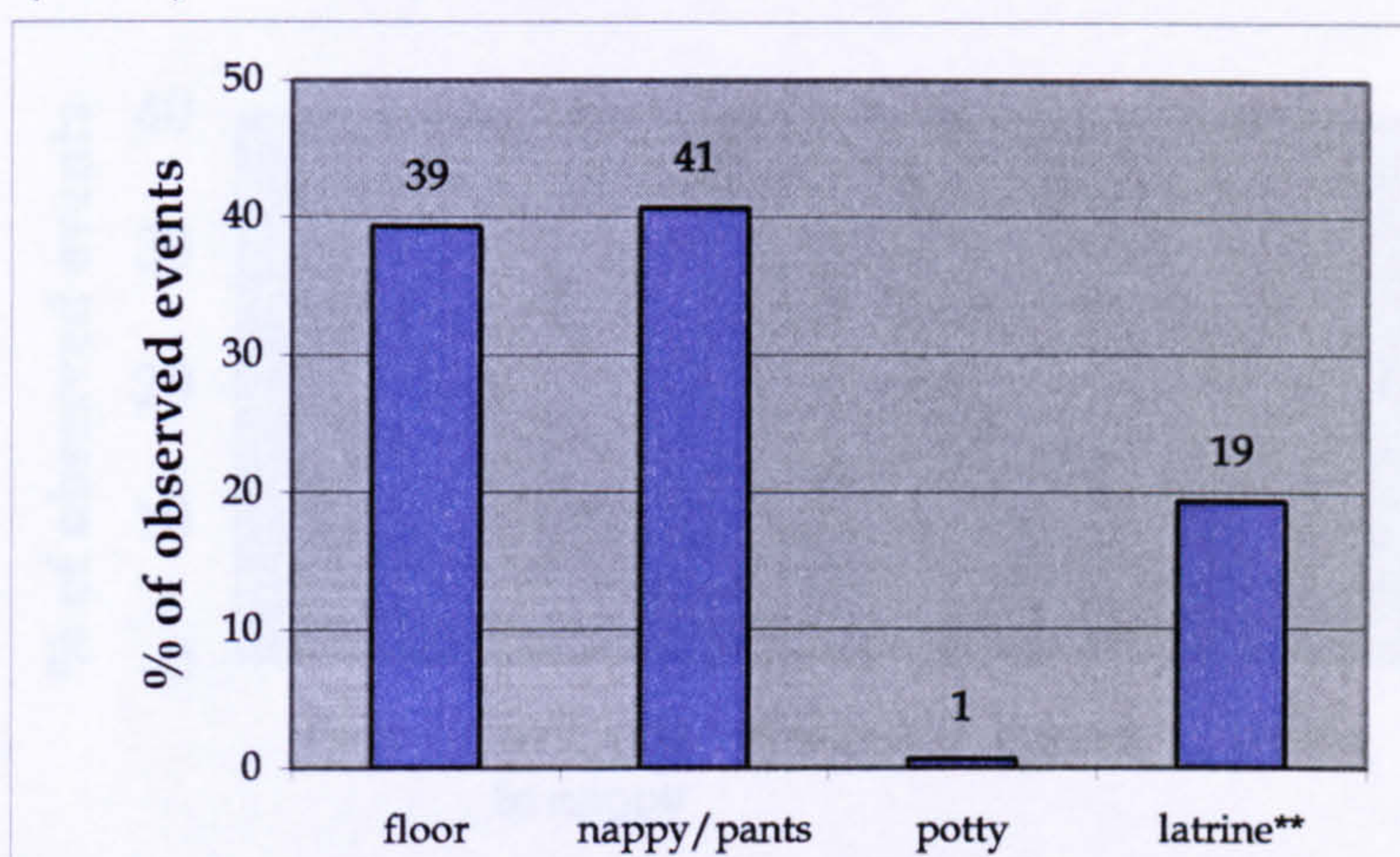
Throughout the 3 rounds of observations, 125 children, from 0 to 60 months old, were observed defecating outside the latrine in 84 households. They defecated either on the floor, potty, or in nappies²⁷ and pants.

Ninety-one children, ranging from 24 to 156 months, were seen using the latrine and suspected to have defecated.

On 69% of occasions where children were seen using the latrine or performing open defecation within the yard, the actors were under 5 years of age. Figure 7-3 shows the observed defecation sites recorded on those occasions.

²⁷ Nappies in this context included not only the thick, absorbent cloth (which was rarely seen in this study) to contain the child's excreta, but also any type of cloth folded around a child's bottom. None of the observed "nappies" was disposable. Curtis (1995) referred to them as linen.

Figure 7-3: Observed defecation sites among children under-5 (n=149)*



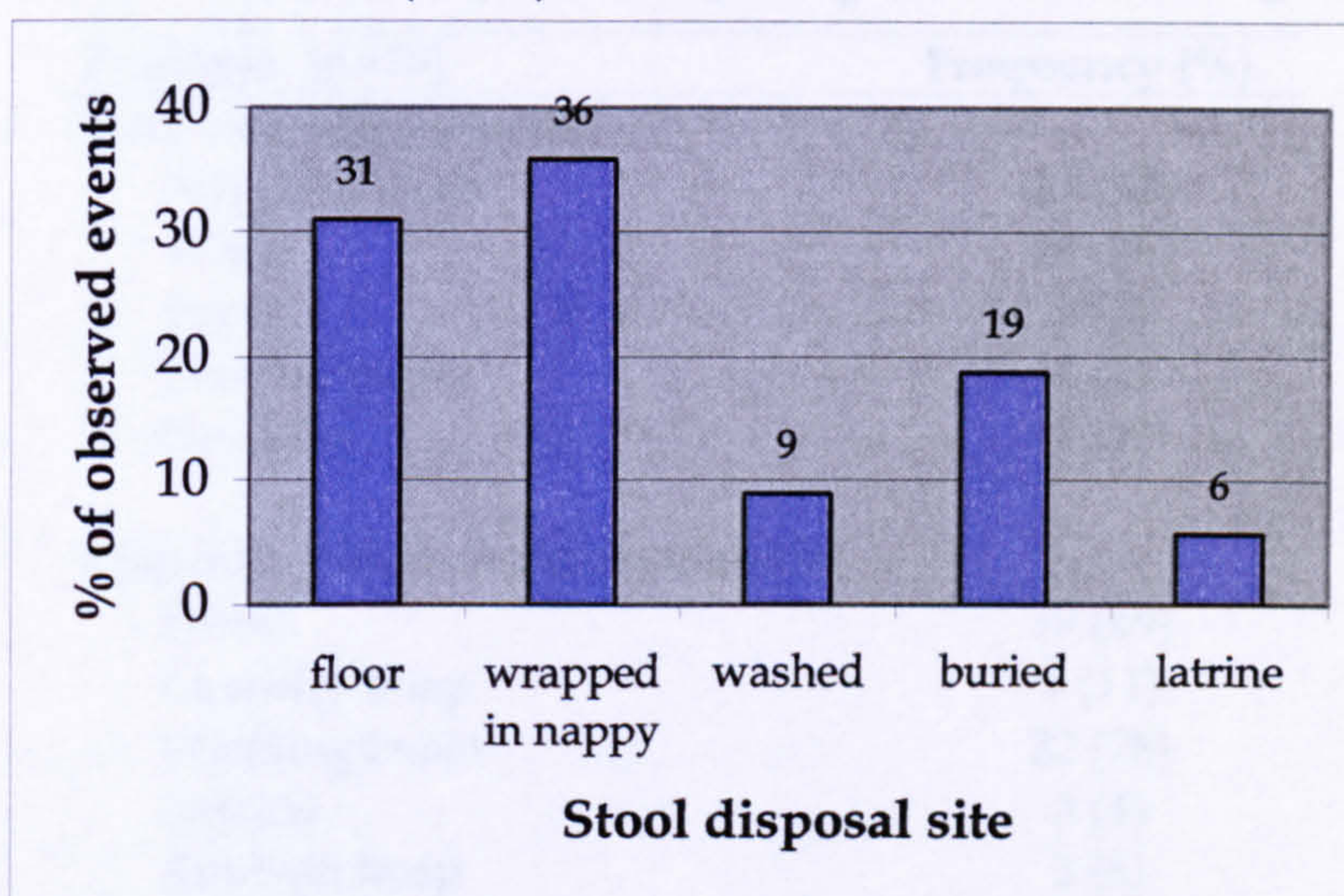
Notes: * 3 rounds of observations were combined

**Suspected defecation events, based on children remaining in latrine for ≥ 2 min.

Disposal of children's stools in the latrine was rare, having been observed on just over 5% of occasions in which a child under-5 had defecated outside the latrine. As seen in Figure 7-4, on most occasions children's stools were either left at the defecation site, or wrapped in the nappies or cloth used for anal cleansing and left on the floor or in an empty plastic basin, presumably for eventual washing.

On 61 (46%) of the occasions where defecation outside the latrine was observed, children defecated in nappies. On under 10% of those occasions, soiled nappies were seen being washed immediately after nappy change and on over 30%, they were set aside, either in laundry heaps or basins, presumably for eventual washing. On the rest of the occasions nappies were placed on the floor.

Figure 7-4: Observed stool disposal of children defecating outside the latrine (n=125)*



Notes: * 3 rounds of observations were combined

After a child had defecated, 79 anal cleansing events were observed. The anal cleansing practices observed offered potential routes for faecal contamination of the domestic environment.

Caretakers used a range of materials to cleanse the child, namely, leaves, toilet paper, nappies, pieces of clothing, and water (Table 7-3). When unattended, children usually wiped themselves with earth to remove the faeces. Cleansing materials were subsequently disposed of on the floor, washing basins or laundry heaps, and less so in latrines and rubbish heaps.

Table 7-3: Observed practices regarding child anal cleansing

Practices (n=79)	Frequency (%)
Anal cleansing material	
Nappies/cloth	41 (52)
Water	28 (35)
Earth	5 (6)
Leaves/paper	4 (5)
No data‡	1 (1)
Disposal of anal cleansing material	
Floor	39 (49)
Laundry heap	9 (11)
Washing basin	22 (28)
Latrine	3 (4)
Rubbish heap	5 (6)
No data‡	1 (1)

‡ On this occasion, child was taken out of sight and came back clean

c) Cleanliness and organisation of the yard

Yard-sweeping usually happened first thing in the morning. The yard had traces of having been swept on 40% of the occasions where observation took place and human excreta were seen on the ground at least once on 17% of those occasions.

The number of houses that reported having domestic animals or livestock was 221. In only 10% of these were the animals seen enclosed. This was the case for cattle and goats, meaning that all other types of animals were likely to be free range.

In 39% of the households dish racks were observed in the yard, where all kitchen activities take place during the day. The others used plastic basins, bricks, or the floor to temporarily place the utensils while cooking took place.

d) Water

As seen in Chapter 5 (section 5.4.3), the majority of households (62%) collected their drinking water from taps, about half of them from the public domain. Only 12% of households had their own water sources within the yards,

however over ½ of the households (52%) collected their drinking water from neighbours. This means that the few households with their own water source provided their water to others as well.

The most common water container was the 20 Litre jerrycan which was used to collect and store water. Stored water was observed 143 times in 84 households, and in only 4% were all observed water vessels covered at all times when water was not being used (Table 7-4).

Table 7-4: Observed water storage conditions

Share of occasions the condition was observed (n=82)	Number of households (Percentage)
All containers with a lid in place when water not in used	
Never	75 (89)
Sometimes	6 (7)
All occasions	3 (4)

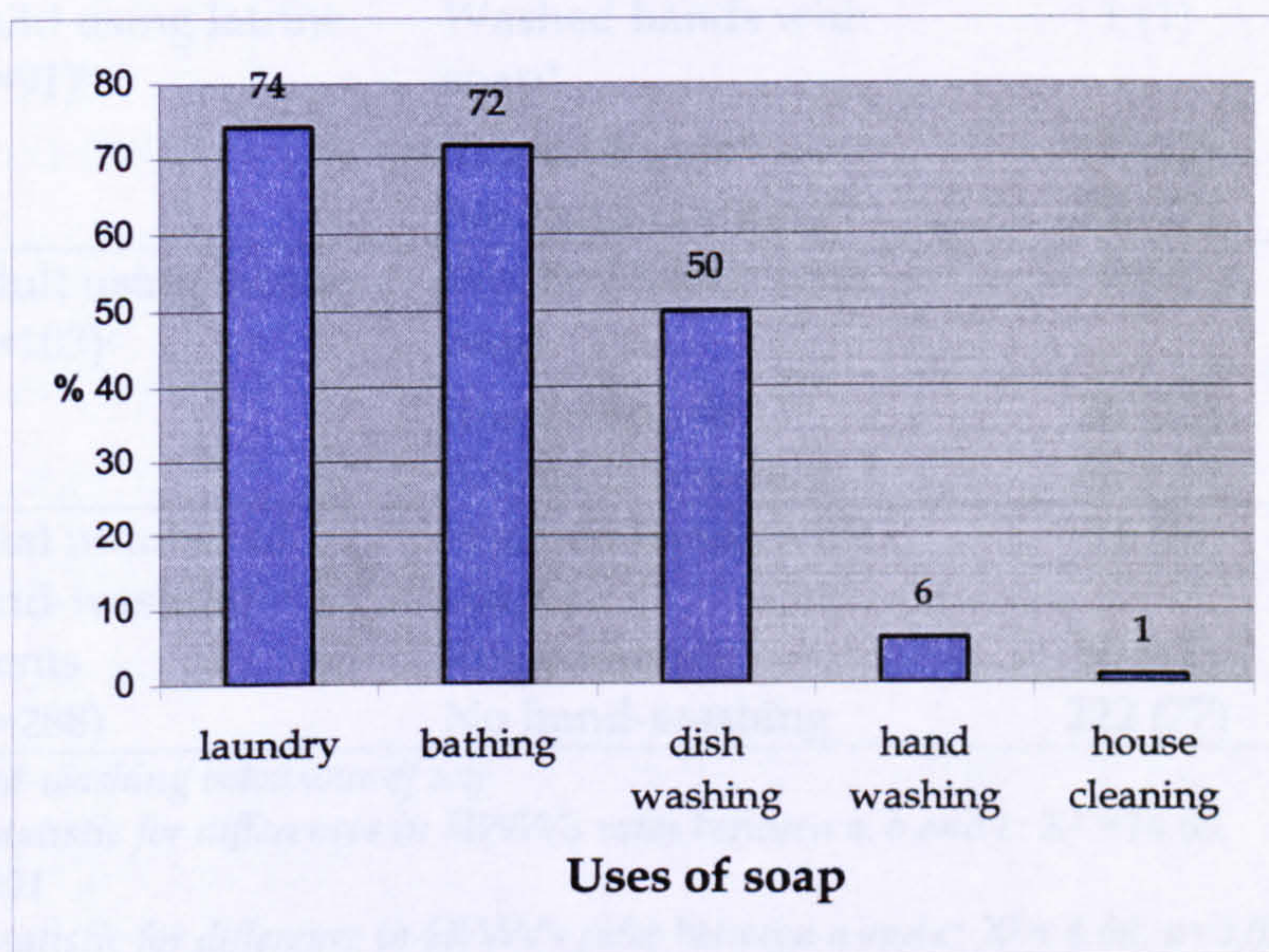
e) Soap availability and usage patterns

Soap was present in 82% of the surveyed households. Little evidence for the employment of soap for hand-washing after toilet use was found. Hand-washing was among the least reported uses of soap in the surveyed households. The principal activity involving soap was laundry, followed by bathing (Figure 7-5).

Out of the 137 latrine visits in 92 households, soap and water were seen in the immediate surroundings of the latrine in only one household, and in 4 households was water seen in the vicinities of the latrine. All 5 households shared the fact that the HoH were male, regularly salaried, and with 4-9 years of education. Further the principal caretakers had 4-9 years of education, were married to the HoH, and were either housewives or fruit vendors. All collected drinking water from taps, two from their own yards.

In the house with soap in the vicinity of the latrine the HoH was a clerk and in the households with water only they were sugar cane factory employees, a driver, and a locksmith.

Figure 7-5: Reported uses of soap in households (n=333)



Note: Respondents were allowed to report more than 1 use

7.3.2 Factors associated with hygiene and sanitation practices

f) Hand-washing practices after potential faecal contact

Throughout the 3 rounds of observation visits, 288 events considered as opportunities for hand washing were observed (Table 7-5); yet hand-washing with soap was observed on only 6% of those events. Although also rare, the practice of simply rinsing both hands was more common compared to hand-washing with soap, having been observed on 17% of the hand washing opportunities.

On the 66 occasions when hand-washing was recorded, the vast majority (76%) dipped the hands in a bowl with water and the rest poured water on hands with a cup. Half of those that used a bowl did it with re-used water.

Table 7-5: Hand-washing behaviours during 3 rounds of observations, by type of event preceding the behaviour

Critical event	Hw Behaviour	Frequency (%)
Handling of child's stools (n=94) ^a	Washed hands with soap	6 (6)
	Rinsed hands	13 (14)
	No hand-washing	75 (80)
Child using latrine (n=91) ^b	Washed hands with soap*	1 (1)
	Rinsed hands*	11 (12)
	No hand-washing*	79 (87)
Adult using latrine (n=103) ^c	Washed hands with soap	9 (9)
	Rinsed hands	26 (25)
	No hand-washing	68 (66)
Total number of hand-washing events (n=288)	Washed hands with soap	16 (6)
	Rinsed hands	50 (17)
	No hand-washing	222 (77)

* Hand-washing behaviour of self

Test statistic for differences in HWWS rates between a, b and c: $X^2 = 14.60$, $p = 0.001$

Test statistic for difference in HWWS rates between a and c: $X^2 = 4.68$, $p = 0.03$

7.3.2 Factors associated with hygiene and sanitation practices

a) Latrine possession

The univariate analysis showed an association between latrine possession and one of the wealth variables: *accumulation of modern assets* (Table 7-6, column 2). Households in the top quartile of scores for this variable were 3 times more likely to have a functioning latrine compared to those in the lowest quartile (OR= 2.8, 95% CI= 0.7- 11.2)²⁸

Caretaker's education was also associated with latrine possession. As seen in Table 7-6 (column 2), compared to the baseline group, households belonging to the highest *caretaker education* quartile were 3 times as likely to have a functioning latrine (OR= 3.0, 95% CI = 0.9- 9.8).

²⁸ Stratum-specific OR were obtained, but the OR presented in tables 5-5 and 5-6 in the present chapter are Mantel-Haenszel OR.

Since education and wealth could be correlated, an investigation of interaction was conducted. When controlling for wealth, the association of caretaker's education with latrine possession remained significant, as shown in Table 7-6 (column 3), suggesting that caretaker's education is an independent predictor of latrine possession.

b) Yard clear of human faeces

Two factors were significantly associated with not having stools on the ground, namely *water source type* and *HoH socio-economic status*. Compared to households using a tap, those using water from wells, pumps or springs were nearly 3 times less likely to have grounds clear of human faeces (OR = 0.4). Those in the top quartile of *HoH socio-economic status* scores were 4 times more likely to have a yard clear of faeces compared to those in the lowest quartile (OR= 4.0, 95% CI = 1.1- 15.2).

Since type of water source could be related to wealth, an investigation of this interaction in association with this proxy for stool removal behaviour was conducted. In the multivariate analysis the association of the outcome with *HoH socio-economic status*, and *water source type* remained. This can maintain the suggestion that water source's influence is not entirely explained by wealth.

Table 7-6: Univariate and multivariate analysis of predictors of excreta-disposal related HHEH outcomes.

Predicted factors	Latrine possession (n=405)		Safe disposal of children's faeces (n=84)†		Yard clear of human excreta (n=104)	
	Crude OR [95% CI]	Adjusted OR [95% CI]	Crude OR [95% CI]	Adjusted OR [95% CI]	Crude OR [95% CI]	Adjusted OR [95% CI]
<i>HoH socio-economic status*</i>	1.22 [0.81- 1.84]	-	1.91 [1.25- 2.92]**	1.54 [1.09- 2.17]*	1.56 [1.07- 2.28]*	-
<i>HH modern assets*</i>	1.52 [1.00- 2.30]*	1.27 [0.79- 2.03]	0.67 [0.44- 1.03]	1.32 [0.94- 1.86]	-	-
<i>HH traditional assets*</i>	0.76 [0.50- 1.24]	-	0.98 [0.64- 1.49]	0.76 [0.54- 1.08]	-	-
<i>CT educational status*</i>	2.10 [1.37- 3.13]**	2.22 [1.28- 3.84]**	†	1.40 [1.00- 1.97]	-	-
<i>CT financial independence</i>	1.34 [0.80- 2.01]	-	†	0.79 [0.56- 1.11]	-	-
<i>CT decision-making power*</i>	0.86 [1.57- 1.30]	-	†	1.10 [0.78- 1.55]	-	-
<i>Ct exposure to information*</i>	1.34 [0.89- 2.01]	-	†	0.71 [0.51- 1.00]	-	-
<i>CT proximity to own family*</i>	0.90 [0.60- 1.36]	-	†	0.92 [0.65- 1.29]	-	-
<i>Water source (location)</i>	-	-	0.73 [0.33- 1.59]	0.55 [0.31- 1.00]	-	-
In yard/ Neighbouring house/ Public	-	-	0.87 [0.48- 1.58]	0.54 [0.33- 0.89]*	0.60 [0.38- 0.94]*	-
<i>Water source (type)</i>	-	-	-	-	-	-
Tap/pump/well or spring	-	-	-	-	-	-

* Quartiles

**p<0.005

* p<0.05

†84 was the number of households where at least one child defecation event was seen

Crude OR = Mantel-Haenszel odds ratio score test for trend, from univariate analysis

Adjusted OR = Adjusted trend odds ratio, from multivariate analysis

†These associations were analysed using a model accounting for repeated measurements and different actors in each occasion (see Table 7-7). This model did not allow MH OR

c) Safe stool disposal practices

Safe stool disposal thus defined was significantly associated with only one wealth characteristic, which was *HoH socio-economic status* (Table 7-6, column 4). In houses belonging to the highest quartile of scores on this variable, caretakers were 6 times more likely to have ever been observed disposing of the child's stools in a safe way compared to the households in the lowest quartile (OR = 6.2, 95% CI= 1.3- 29.8).

Table 7-7 shows the results of the univariate analysis of directly observed stool disposal, accounting for repeated observations involving different children and different caretakers handling the stools. Age of the child showed an association with mode of stool disposal in that the likelihood of safely disposing of children's faeces steadily increased significantly from age group 0-11 months (baseline) to 24-35 months (stratum specific OR of 8) and then decreased, but not significantly from this age group to the age group of 36 months and over. There was a steady increase in the likelihood of engaging in the safe practice with increase in caretaker's age, however this apparent trend was not significant (Table 7-7).

Table 7-7: Analysis of associations between safe disposal of child's faeces and caretaker's and child's actors attributes, taking into account variation of actors and clustering of households

	OR [95% CI]	P> z
Caretaker or child's attribute		
<i>Ct education and information*</i>		
Lowest	1.00 (ref)	-
Lower-middle	0.68 [0.20- 2.35]	0.538
Upper-middle	1.65 [0.51- 5.40]	0.406
Highest	0.87 [0.24- 3.23]	0.839
<i>Ct financial independence*</i>		
Lowest	1.00 (ref)	-
Lower-middle	1.11 [0.38- 3.28]	0.849
Upper-middle	0.46 [0.12- 1.72]	0.249
Highest	0.40 [0.12- 1.36]	0.144
<i>Ct proximity to own family*</i>		
Lowest	1.00 (ref)	-
Lower-middle	0.60 [0.19- 1.92]	0.385
Upper-middle	0.31 [0.08- 1.17]	0.084
Highest	0.62 [0.20- 1.91]	0.402
<i>Ct autonomy*</i>		
Lowest	1.00 (ref)	-
Lower-middle	1.26 [0.46- 3.49]	0.652
Upper-middle	0.62 [0.21- 1.83]	0.385
Highest	1.03 [3.33- 3.19]	0.954
<i>Ct age (years)</i>		
< 19	1.00 (ref)	-
20_29	1.88 [0.16- 21.86]	0.615
30_39	2.68 [0.33- 21.68]	0.356
40_74	5.72 [0.59- 55.43]	0.133
<i>Child's age (months)</i>		
0-11	1.00 (ref)	-
12-23	7.93 [1.62- 38.90]	0.011*
24-35	8.40 [1.61- 41.02]	0.011*
≥ 36	3.07 [0.59- 15.83]	0.180

* p < 0.05

N. obs. = 125

N. of groups = 84

Obs. Per group min=1; max = 4; avg. = 1.4

* Quartiles

OR= stratum-specific odds ratios

d) Soap possession

There was a statistically significant association between soap possession and *HoH socio-economic status*, *Accumulation of modern assets*, *Caretaker's education* and *Exposure to information*. Compared to households in the lowest quartile of *HoH socio-economic status* scores, those at the top quartile were 3 times more

likely to have soap (OR= 3.5, 95% CI= 1.6- 7.4). The likelihood of having soap amongst those in the top quartile of *Accumulation of modern assets* scores was twice of that in the baseline group (OR = 2.3, 95% CI = 1.0- 5.1).

With regards to the caretaker's attributes, there was a 5 fold increase in the likelihood of soap possession amongst those in the top quartiles of *Caretaker's education* (OR= 5.2, 95%CI = 2.2- 12.5) and *Exposure to information* (OR= 5.5, 95%CI = 2.2- 13.7) compared to the respective baseline groups.

All the above significantly associated variables with soap possession could be interrelated. After being included in a logistic regression model, the association between soap possession and *Accumulation of modern assets* did not maintain. For the other factors, the odds ratios were reduced in magnitudes but the associations remained significant.

e) Hand hygiene after potential faecal contact

None of the proposed wealth variables seemed to predict hand-washing behaviour after handling the child's faeces, as shown in Table 7-8.

Taking into account the attributes of the secondary caretakers, i.e., those people that were the actual carriers of the hand-washing behaviours irrespective of them being the thus defined principal caretakers, no significant associations with hand hygiene were seen either. However, looking at the characteristics of the few hand-washers, it was observed that, among the group of children using the latrine, virtually none washed their hands. Amongst the caretakers cleansing children, hand-washers tended to fall within the age group between 20 and 39 years old. In other words, very young or very old caretakers were the least likely to wash their hands.

Moreover, when all hand-washing events were broken down by event preceding them (Table 7-5), it seemed that adult latrine users were more likely to wash their hands compared to both child latrine users and caretakers handling children's stools ($p=0.001$).

Table 7-8: Univariate and multivariate analysis of predictors of hand hygiene related HHEH outcomes

Predicted Factors	Soap possession (n=405)		Hw after handling child's stools (n= 72)
	Crude OR [95% CI]	Adjusted OR* [95% CI]	
<i>HoH socio-economic status*</i>	1.65 [1.32- 2.07]**	1.53 [1.18- 1.99]**	0.85 [0.52- 1.37]
<i>HH modern assets*</i>	1.30 [1.03- 1.63]*	-	1.01 [0.63- 1.63]
<i>HH traditional assets*</i>	1.17 [0.93- 1.46]	-	0.75 [0.46- 1.20]
<i>CT education*</i>	1.63 [1.30- 2.04]**	1.54 [1.19- 1.98]**	†
<i>CT decision-making power*</i>	1.07 [0.86- 1.35]	-	†
<i>CT financial independence*</i>	1.24 [0.99- 1.56]	-	†
<i>CT exposure to information*</i>	1.52 [1.21- 1.91]**	1.35 [1.04- 1.74]*	†
<i>CT proximity to own family*</i>	-	-	†
<i>Water source (location)</i>	-	-	0.59 [0.25- 1.39]
In yard/ Neighbouring house/ Public			
<i>Water source (type)</i>	-	-	1.39 [0.71- 2.75]
Tap/pump/well or spring			

* Quartiles

**p<0.005

* p<0.05

Crude OR = Mantel-Haenszel odds ratio score test for trend, from univariate analysis

Adjusted OR = Adjusted trend odds ratio, from multivariate analysis

†These associations were analysed using a model accounting for repeated measurements (see Table 7-9). This model does not allow MH OR

Table 7-9: Analysis of associations between hand-washing after handling child's faeces and attributes of handler and child, taking into account variation of actors and clustering of households

	OR [95% CI]	P> z
Caretaker or child's attribute		
<i>Ct education and information*</i>		
Lowest	1.00 (ref)	-
Lower-middle	0.36 [0.06- 2.08]	0.25
Upper-middle	0.50 [0.11- 2.32]	0.38
Highest	2.65 [0.69- 10.18]	0.16
<i>Ct financial independence*</i>		
Lowest	1.00 (ref)	-
Lower-middle	0.10 [0.02- 0.57]	0.05
Upper-middle	0.38 [0.10- 1.45]	0.16
Highest	0.43 [0.10- 1.79]	0.24
<i>Ct proximity to own family*</i>		
Lowest	1.00 (ref)	-
Lower-middle	5.25 [0.58- 7.47]	0.14
Upper-middle	8.99 [0.91-89.01]	0.06
Highest	6.34 [0.67- 60.35]	0.11
<i>Ct autonomy*</i>		
Lowest	1.00 (ref)	-
Lower-middle	0.09 [0.01- 0.92]	0.05
Upper-middle	1.18 [0.31- 4.49]	0.81
Highest	0.61 [0.15- 2.38]	0.47
<i>Ct age (years)</i>		
< 19	1.00 (ref)	-
20_29	0.73 [0.07- 7.95]	0.15
30_39	3.29 [0.36- 30.33]	0.29
40_74	6.32 [0.53- 75.97]	0.80
<i>Child's age (months)</i>		
0-11	1.00 (ref)	-
12-23	0.93 [0.26- 3.33]	0.91
24-35	0.79 [0.18- 3.43]	0.75
≥ 36	0.53 [0.09- 2.99]	0.47

N. obs. = 94

N. of groups = 72

Obs. Per group min=1; max = 3; avg. = 1.3

* Quartiles

OR= stratum-specific odds ratios

Variables that remained significantly associated with any of the 5 hygiene and sanitation practices investigated in this chapter ($p < 0.05$), after controlling for possible interactive variables, are schematised in Table 7-10. These results are discussed in the section that follows.

Table 7-10: Factors associated with five forms of hygiene and sanitation practice

Predicting factors	Hygiene and sanitation practice (Adjusted OR, 95% CI)			
	Latrine possession	Safe disposal of child's faeces	Yard clear of human excreta	Soap possession
<i>CT educational status</i>	2.22 [1.28- 3.84] **			1.54 [1.19- 1.98] **
<i>CT exposure to information</i>				1.35 [1.04- 1.74] *
<i>Child's age</i>		†*		
<i>HoH socio-economic status</i>		1.91 [1.25- 2.92] **	1.56 [1.07- 2.28] *	1.53 [1.18- 1.99] **
<i>Water source (type)</i>			0.60 [0.38- 0.94] *	

**p<0.005

* p<0.05

†These associations were analysed using a model accounting for repeated measurements (see Table 7-9). This model does not allow MH OR

7.4 Discussion

It was shown here that basic hygiene and sanitation hardware, namely functioning latrines, water, and soap, were available in most households. Equally almost universal latrine possession was observed in rural areas of Kenya, Tanzania and Uganda (Tumwine *et al.*, 2003). However, overall, the environmental risk practices for diarrhoeal diseases were very prevalent. Not only was this study useful in quantitatively documenting patterns of these practices, but also in exploring likely predictors for them.

7.4.1 Hand-washing

Rates of hand-washing with soap after critical events were low (6%). These rates are half of those reported in Peru (e.g., Huttly *et al.*, 1994), and compared to the spectrum of hand-washing prevalences after cleaning the child reviewed by Scott (2003), the present population ranks as the second lowest prevalence reported, after a prevalence of zero in rural Kyrgyzstan (Biran *et al.*, 2005).

None of the hypothesised factors seemed to predict this behaviour. This added to earlier findings that wealth did not predict hand-washing in Peru (Gilman *et al.*, 1993) nor did mother's education in Nicaragua (Gorter *et al.*, 1998).

However, some aspects of the present findings help to shed light into factors enabling or hindering hand-washing. There was a slight indication that hand-washing after handling children's stools could be associated with the handler's age, as a steady increase in the odds of hand-washing was observed with increased age of the caretaker, bringing some support to the idea of nurture as an important drive for hand-washing (Scott *et al.*, 2003). This should

be interpreted with caution as such association in the present study was not significant. If this were true, hygiene promotion could be currently devoting more efforts to targeting people that already have the drive for the behaviour, than to emphasise the practice on very important groups of people that actually do most of the childcare: the non-mothers (grand-mothers, and young siblings) of children under 5.

More importantly, hand washing after handling children's faeces could be hindered by perceptions of child's faeces²⁹ (Curtis *et al.*, 2003; Fukumoto *et al.*, 1989; Kaltenthaler & Drasar, 1996b; Scott *et al.*, 2003), as adults were significantly more likely to wash their hands coming out of the latrine than when child's stools were handled. Aspects related to perceptions of children's faeces are explored with more depth in Chapter 10.

Also important is the fact that whilst hand-washing has been dubbed a simple intervention (Curtis *et al.*, 2001), data presented here shows that in this setting the behaviour can be quite complicated. It was noted for example that in all but 5 households, no particular site within the yard could be identified as a "hand-washing spot", and it was noted that a single hand-washing episode entailed a complex sequence of behaviours that started from fetching a water container, through to pouring water in it, getting the soap, taking the soap and the water to the right spot where water was allowed to be run to waste, followed by the actual washing of hands. Hand-washing has been observed to be a complex behaviour in rural, poor settings elsewhere (Hoque & Islam, 1995).

7.4.2 Soap possession and use

Most houses had soap and this product was mostly used for activities other than hand-washing.

The presence of soap was highly influenced by *caretaker's education, HoH socio-economic status, and caretaker's exposure to information*, suggesting that

²⁹ In other settings, for example Kerala, mothers viewed children's stools as harmless (Scott *et al.*, 2003).

besides wealth an informed caretaker can play an influential role on the household's acquisition of soap. It could be that caretaker's exposure to information reflects access to information endowed to the household members in general, which in turn influences purchase of soap out of initiatives by householders other than the caretaker.

Moreover, contrary from the suggestion that control over financial resources facilitated purchase of soap (Halvorson, 2004), in the present study the financial independence of the caretaker was not an important factor, which proposes that cash needed for soap can most likely come from the head of household, than from the women. Similar results were found in Manica province (Central Mozambique), which concluded that educated mothers were better at guaranteeing their children's nutrition compared to their non-educated counterparts, not because of own salary differentials, but because educated women had better means of directing their husbands' money towards investment in the household's diet (Pfeiffer *et al.*, 2001).

7.4.3 Latrine ownership

With such high latrine coverage, it was expected that latrine possession would be homogeneous across the socio-economic and demographic strata identified in this study. Nonetheless, latrine possession was associated with *caretaker's education*, which remained strong when controlling for wealth, in that among those with no latrines, caretakers remained significantly more likely to have no education compared to the group of households with latrines. This offers the suggestion that educated women had an influential role in acquisition and maintenance of latrines, despite the fact that the autonomy variables did not correlate with latrine possession. However, latrine possession could not be entirely explained by *Caretaker's education* because there were households that had functioning latrines but the principal caretakers had no formal education.

The lack of an association between latrine ownership and wealth contrasted with a study in Kenya, Tanzania, and Uganda, where latrine coverage was also high but HoH education and occupational status was a

strong predictor of latrine possession (Tumwine *et al.*, 2003). In this thesis, the relationship between latrine ownership and wealth is also explored qualitatively (Chapter 10).

Despite the high coverage of latrines in this setting, the majority failed to serve their purpose of entirely isolating faeces from the environment, from the latrines themselves being soiled with faeces, to children's faeces not being disposed of in latrines.

7.4.4 Stool disposal practices

Practices that were evidently likely to be contributing to the faecal contamination of the environment were, children defecating on sites other than latrines, unsafe disposal children's stools, soiled nappies, and anal cleansing materials. Different reasons could account for why children were not seen using toilets. Brandberg (1985) found that the latrines observed were structurally unsafe for children in peri-urban Maputo (Mozambique). These and other reasons related to safety and lack of discipline have been mentioned elsewhere (Boot & Cairncross, 1993), such as children disliking the smell, and being afraid of the dark or of the defecation hole. The qualitative study (Chapter 10) discusses this problem from the perspective of caretakers.

However, it was noted that children's faeces were not indiscriminately located, but placed on particular corners of the yard, meaning that there was some level of control over small children's defecation habits. These results do not conform with the only study that looked at child defecation practices in such detail (Yeager *et al.*, 1999), which held that children could go when and where they liked to defecate, involving in this way much less work for the mother. An interesting association was seen between patterns of disposal of children's stools and their age. Faeces of very young children (less than 1 year olds) and older children (over 3 years old) were likely to be left not disposed of compared to faeces of children of ages in between. This finding points to three aspects. The first is that infants and toddlers are constantly under care; therefore their faeces are more likely to be immediately handled. However,

since infants tend to defecate in nappies, eventually they are washed with the faeces, and the water (which is fecally contaminated) is subsequently unsafely disposed of. On the other hand, toddlers tend to defecate on the floor and the caretaker is therefore likely to bury or throw the faeces in the latrine immediately after, if she is being supervised. Older children, which are more independent yet not old enough to use the latrine, tend to hide to defecate and no one is there to clean it up since they are no longer under constant supervision. Therefore, the most likely sources of faecal contamination in the homes are infants and older children's faeces, compared to those of toddlers.

In Peru age-related defecation patterns were also observed (Huttly *et al.*, 1994), however somewhat different from the present study. In Lima potties were more popular than in Manhiça therefore the former study found more children in the age group 24-36 months using a safe defecation site. Moreover, children in Lima were using nappies until a period much later than that found in this study, where children stopped defecating in nappies or panties at 12 months, resorting to the floor.

The lack of an association between safe stool disposal and *caretakers education* is concordant with earlier studies which showed no statistically significant associations between stool disposal practices and maternal education in Burkina Faso (Curtis *et al.*, 1995) and Nicaragua (Gorter *et al.*, 1998). In contrast, all aspects of safe stool disposal under study had an association with *HoH socio-economic status*, which is concordant with results from Burkina Faso (Curtis *et al.*, 1995) and East African countries (Tumwine *et al.*, 2003).

This study identified and detailed a practice that has not deserved attention in the study of sanitation behaviours, which is treatment given to cleansing and other soiled materials from defecation, in particular wastewater from washing fecally contaminated clothing and children's bottoms. Emphasising this practice is particularly important because it also accounts for the final destination given to stools since, when observed, the most common practice was to dispose of the waste water somewhere in the yard, or leaving the used water in the basin at the risk of reuse (including for hand-washing).

Patterns of this practice are worth investigating, since it contributes to further contamination of the domestic environment with diarrhoeal disease pathogens.

7.4.5 Water source as a predicting factor for hygiene behaviour

Water source predicted one aspect of safe disposal of human faeces.: traces of safe stool disposal in the yard. These results were similar to Curtis' (1995) in that water source predicted a practice not involving water; pointing to the likelihood that water source was not a direct enabler of this practice. However, the results differed from Curtis' (1995) in that in the present study it was the type of water source and not the location that was an important predictor of safe stool disposal. One of Curtis' suggestions was that water source in the yard provided more time for hygienic behaviours compared to those relying on standpipes and wells outside (Curtis *et al.*, 1995). However it was not clear from that study whether the authors were measuring access or quality of water source. Curtis' suggestion does not hold in the present study because location of water source showed no association with any form of safe disposal of stools observed.

The association between water source type and safe stool disposal was not explained by wealth, as in the multivariate analysis such associations remained significant. Curtis' second suggestion to their results in Burkina was that people with taps in the yard were expected to behave more hygienically by society (Curtis *et al.*, 1995). The present results tend to concord with this suggestion, adding to the argument that the choice of water source type, irrespective of its location, can be a social status marker, which obliges people to conform to other hygienic behaviours. This was in line with what was found in Bangladesh, where educated women were adamant to use tubewell water for domestic hygiene as opposed to surface waters as a reflection of a desire to show social gentility (Lindenbaum *et al.*, 1989). However, hand-washing behaviour had no association with water source type, suggesting that if a hygiene attitude exists it does not strongly affect hand-washing, perhaps because the behaviour is not much visible to others as compared to traces of

stool disposal. Additionally, in the present study education was not a predictor of safe disposal of faeces stools therefore other underlying factors, for example wealth, might be operating in endowing women with ability to express the above described "social gentility".

7.5 Conclusions

All in all *HoH socio-economic status*, and *caretaker's educational status* were important predictors of hygiene and sanitation practices in different ways. While *caretaker's education* was an important predictor of availability of hygiene and sanitation hardware, it did not predict the directly observed hygienic behaviours. Drawing on qualitative data from Pakistan, Halvorson (2004) suggested women's sense of powerlessness to impede their influence on behavioural changes within their own homes. It could therefore mean that while education can help women contribute in the acquisition of products that facilitate their domestic work (soap and latrines), education status still cannot overcome other forces, to do with power relations within the homes, which might influence behaviour of the household as a whole.

HoH socio-economic status predicted the presence of soap and both aspects of safe removal of faeces, but did not predict hand-washing behaviour nor latrine possession, suggesting that while soap possession can be hindered by economic constraints, latrine possession depends on other factors. The link with stool disposal practices strengthens the suggestion that safe stool disposal practices might be products of statements associated with status as seen with the relationship between the same behaviour and water source type, which was not seen with any other of the studied behaviours.

A major limitation to this study was that structured observations were carried out at the expense of sample size. However, this technique is considered the best available to monitor behaviour. Issues of reactivity were addressed by intensive training and visiting the households more than once to build rapport. Further, it is true that observers were not there for an indefinite time to

ascertain what the final destination of the faeces was, therefore for the purposes of questioning the usefulness of the method used to collect the data this observation is not useful. However, it is useful in public health terms, as often the faeces (or soiled materials) that were classified as "unsafely disposed of" were left exposed (not buried, not thrown in latrine, or safely washed away) for enough time for flies, domestic animals or children to come into contact with them, contributing to the spread of pathogens within the home environment.

The main implications from the findings presented in this chapter arise from the suggestion that factors that differentiate households in terms of wealth, education, and exposure to information might play a role in influencing the engagement in socially visible behaviours, such as cleanliness of the yard. However from these data we can only speculate that such behaviours might be more socially ascribed than hand-washing. Should this be true, the importance that people in this setting give to yard sweeping could be comparable to the value of personal appearance seen in Peru, which led people to be more likely to engage in hand-washing before going out (Huttly *et al.*, 1994). It would then follow that adequate removal of child's faeces had potential of being incorporated with ease in messages highlighting the social value associated with a clean yard.

Hand-washing is definitely a practice that urgently requires to be promoted. Despite some existing insights into personal motivators for hand-washing, for example disgust and nurture (Scott *et al.*, 2003), the latter was only slightly captured in this study. Most enabling factors for hand-washing remain imprecise and need to be further explored. However, the findings suggest that a convenience factor for hand-washing is lacking in this setting. Therefore, as well as promoting the hand-washing behaviour *per se*, emphasis should be given to the practice of making soap and water readily available at appropriate spots that would encourage householders to wash their hands with minimum effort. This responsibility could arguably be given to the housewives and/or principal caretakers of small children, who spend most of the time in the homes

and are liable to other domestic hygiene practices that involve water and soap (e.g., washing dishes, doing the laundry, and bathing children).

The findings on soap suggest that more than latrines, the poorer households will be less likely to have access to it, with serious implications for promotion of hand-washing with soap amongst this group. Hand-washing campaigns report the use of mass media channels (e.g., Scott *et al.*, 2002), therefore again the messages will be less likely to reach those with no access to such communication channels.

Chapter 8 Mosquito deterrence practices

Chapter summary

This chapter is organised as follows. Firstly it introduces the topic by highlighting the key points drawn from the literature review (Chapters 2 and 3), which support the argument underlying the choice of practices under investigation and the likely predictors of such practices. Next, a brief account of the data collection and analysis methods used for this chapter is given. The analysis strategy follows, which is similar to that conducted for the diarrhoeal disease related variables (Chapter 7). The subsequent section comprises the descriptive results, which gives an account of the coverage and patterns found in mosquito deterrence practices under consideration. The types of housing design encountered in the study area, which might have implications for mosquito protection is also addressed. Next, factors associated with the differences found across households with regards to mosquito avoidance practices are investigated. The chapter finalises with a discussion of the findings and a conclusion.

8.1 Introduction

This chapter looks at household-level practices and conditions that can reduce mosquito-human contact, which could therefore serve to prevent malaria in children. The preventive practices under consideration are within the spectrum of HHEH practices, as discussed in Chapters 1 and 2.

Use of ITNs at household level has been established as one of the most effective for malaria control as far as current biomedical knowledge is

concerned. A systematic review revealed a 17% protective efficacy of ITNs on overall child mortality compared to no nets, and a reduction of clinical attacks of malaria by 50% (Lengeler, 2004). ITN promotion currently constitutes a central element of the Roll Back Malaria initiative³⁰, which has aimed to achieve a coverage rate of 60% of householders at risk by 2005 (Roll Back Malaria, 2000). Nonetheless, surveys are revealing that coverage of this effective measure is far from reaching satisfactory rates (e.g., Minja *et al.*, 2001; Monash *et al.*, 2004).

Seventy-six percent of the bednets that cover African children are UTNs (Webster *et al.*, 2005), meaning that UTNs are more commonly used in comparison to ITNs.

Evidence to support UTN effectiveness has been variable (Bradley *et al.*, 1986; Campbell *et al.*, 1987; Clarke *et al.*, 2001; Genton *et al.*, 1994; Snow *et al.*, 1988), but more recently it has been roughly estimated that they can offer half the protective effect of that of ITNs (Guyatt *et al.*, 2002; Webster *et al.*, 2005).

As discussed in the literature review (Chapter 2), little is known about the effectiveness of other methods such as traditional fumigators and mosquito coils, although these methods are the most commonly reported amongst households that use mosquito deterrents in Africa (Aikins *et al.*, 1994; Aikins *et al.*, 1993; Evans, 1994; Macintyre *et al.*, 2002; Minja *et al.*, 2001; Ziba *et al.*, 1994). Despite there being studies which have quantified practices involving those products (Agyepong & Manderson, 1999; Evans, 1994; Govere *et al.*, 2000; Lukwa *et al.*, 1999; Macintyre *et al.*, 2002; Samuelsen *et al.*, 2004; Ziba *et al.*, 1994), very few had engaged in an account of specific materials used for the traditional fumigators (Lukwa 1999; Aikins 1994).

House design has been highlighted as an important factor contributing to variations in the incidence of malaria within communities and across adjacent communities (Greenwood, 1999). However a complex interaction of wealth-related factors might come into play in this relationship. Despite this not so clear evidence, studies on this subject have tended to suggest that (i) living in

³⁰ The other two pivotal elements of this initiative are prompt effective treatment of acute cases and intermittent preventive treatment (IPT) in pregnancy (<http://www.rbm.who.int/partnership/>).

bricked houses compared to mud or reed houses is linked with a reduction in malaria outcomes (Gamage-Mendis *et al.*, 1991; Gunawardena *et al.*, 1998; Kahigwa *et al.*, 2002); living in houses with eaves spaces is associated with high risk of infection (Charlwood *et al.*, 2003); (iii) adding ceilings (Kolstrup *et al.*, 1981) or building houses on raised stilts (Charlwood *et al.*, 2003) reduces mosquito densities inside the houses. If this is true, people in more permeable houses are more likely to face nuisance biting hence hypothetically more likely to carry out mosquito deterrence practices. At the same time they are likely to fall in the group of those less capable of carrying out mosquito deterrence practices for reasons of economic constraints. Understanding such contradictions can shed light in better understanding people's behaviour, which calls for more attention to be paid at descriptions of housing structures relevant to mosquito permeability.

In SSA, inter-country differences in mosquito deterrence practices have been reported (Aikins *et al.*, 1994), and there is also documentation of intra community variations (Aikins *et al.*, 1994; Aikins *et al.*, 1993; Evans, 1994; Macintyre *et al.*, 2002; Minja *et al.*, 2001; Ziba *et al.*, 1994). Types of mosquito deterrence practices in rural Mozambique have been inventoried (Dgedge, 2000). However not much detail exists on intra-household patterns of these practices, despite the fears that households may make less efforts to protect children under-5 against mosquito bites compared adults (Korenromp *et al.*, 2003; Mugisha & Arinaitwe, 2003), and engagement in mosquito deterrence practices may be seasonal (Binka & Adongo, 1997), even in settings where malaria transmission is perennial.

Few published studies exist that quantitatively investigate factors associated with household-level mosquito deterrence practices. Level of nuisance has been reported as amongst the chief drivers for the adoption of malaria preventive practices (Agyepong & Manderson, 1999; Evans, 1994; MacCormack & Snow, 1986; Van Bortel *et al.*, 1996; Zimicki, 1997). The importance of nuisance response has been captured in other studies that showed that proximity to alluvial soils (Thomson *et al.*, 1996), or rice fields

(D'Alessandro *et al.*, 1994; MacCormack & Snow, 1986) was associated with increased likelihood of bednet use.

However many studies limit themselves to attributing mosquito deterrence efforts merely to nuisance response (Agyepong & Manderson, 1999). The extent to which nuisance is a sufficient motivator, and the reasons why some households do nothing to combat mosquitoes has received less attention. Further, most information on factors underlying mosquito avoidance practices derived from self reported accounts of the problem and were therefore restricted to viewing the problem from the insider's standpoint alone.

Besides looking into personal motivators for such practices (which are discussed in Chapter 10), there is still a need to explore social and economic factors that could affect the patterns observed, with particular emphasis on the role of caretakers of young children, if children under five are those most at risk to malaria.

Predicting factors for bednet use include: asset possession (D'Alessandro *et al.*, 1994; Nuwaha, 2001), residing in rural areas and living in crowded houses (Agyepong & Manderson, 1999), belonging to a polygamous marriage (Aikins *et al.*, 1994), being an older adult, and having a tradition of bednet use in the family (Aikins *et al.*, 1993). Household and family organization, access to resources, and decision-making processes within the household have all been speculatively suggested as important for the allocation of resources for the purchase of nets (Agyepong & Manderson, 1999) and use by young children (MacCormack & Snow, 1986). This could be true not only for bednet purchase but also for determining appropriate use, and defining priority users. Such household-level dynamics could also be important in explaining the performance of other mosquito avoidance practices. Lessons can be learned from studying factors associated with the use of current traditional techniques of mosquito avoidance and applied in the promotion of approaches such as ITNs.

The overall conceptual framework of this study, which is displayed in Chapter 3 (section 3. 4), bears the following hypotheses specific to this chapter:

The type of mosquito deterrence used in the index child's room is associated with the wealth of the household, caretaker's education, caretaker's decision-making power, caretaker's financial autonomy, caretaker's proximity to own family, caretaker's exposure to information, caretakers' age, and the age of the child being protected. Ever carrying out mosquito avoidance practices to protect the index child is associated with the above variables as well as type of construction of child's bedroom walls.

8.2 Methods

8.2.1 Data collection

Details of the data collection process may be found in Chapter 4.

Information on household-level mosquito avoidance practices was obtained from the socio-economic and demographic questionnaire (Chapter 4, section 4.5.1). This questionnaire and the questionnaire on women's autonomy (section 4.5.2) derived the variables characterizing the caretakers.

Spot checks (section 4.5.3) during the home visits gave an indication of the index child's sleeping quarter's vulnerability to mosquito entry, namely presence of visible gaps and eaves spaces.

8.2.2 Specification and measurement of outcome variables

This section provides operational definitions of the outcome variables on which data were collected. Details on the exposure variables are given in Chapter 6.

a) Wall structure

The wall structures of interest were those of the main building and of the index child's sleeping quarters.

Three possible categories were pre-coded for this variable: "Cement", which included bricked walls and corrugated sheets; "Daubed" where walls were made of reeds or other vegetation but lined with mud or cement; "Bare reeds" when such walls did not have any lining.

b) Visible gaps and eaves spaces in child's sleeping quarters

The outcome was "yes" if there was at least one opening big enough for visible amounts of light to shine through.

c) Mosquito deterrence practice in index child's bedroom

There were 2 variables regarding what had been done to avoid mosquitoes in the room where the index child had slept, namely on the previous night, and during the previous rainy season.

The categories, which were not mutually exclusive, were: "bednet", "sule", "mosquito coil", "aerosol spray", and "nothing". After the respondent had stopped listing the methods the prompt: "anything else?" was given in order to facilitate the recalling process.

If "bednet" was mentioned, then it was asked whether the child had slept under it. If not, then this option was not selected.

If "sule" was mentioned, it led to an open question to describe the materials used.

d) Mosquito deterrence practice in bedrooms other than the index child's

Here the operational definition was the same as that for *mosquito deterrence in the index child's bedroom*, except that this question related to people that had slept in a different room.

If anybody sharing a room with the index child had slept under a bednet but the index child had not, then it was considered that bednet had been used in sleeping quarters other than the index child's.

8.2.3 Data analysis

a) Descriptive analysis

Mosquito deterrence practices to protect the index child on the previous night were expressed in terms of relative frequency of reported used.

These frequencies were compared with:

- Reported practices in bedrooms other than the index-child's on the previous night (in case of bednet use by the index child, it was compared to its use by people other than the index child).
- Practices to protect the same child during the previous rainy season.

In describing mosquito deterrence practices, particular attention was given to the practice of burning organic materials, which had not been extensively documented in great detail. Frequency counts of materials used for *sule* were performed and relative prevalences were tabulated, drawing from an open question, which engaged each respondent in describing their usual procedure to make *sule*.

Relative frequencies of conditions related to permeability of the index children's bedroom to mosquitoes, indicated by types of walls in the index child's bedroom, were calculated and cross-tabulated against the type of walls in the main construction of the house.

b) Univariate analysis

For further analysis the variables describing mosquito deterrence practices in the index child's room were derived into 4 binary variables, each related to whether a specific type of mosquito deterrence practice was carried out for the protection of the index child.

Mosquito deterrence practice in the index child's bedroom was combined with that in the dry season because in the latter season not much mosquito deterrence activity was recorded to give a sufficient sample size to

bear the type of statistical analysis intended to carry out in this chapter. Therefore, for each variable the category "Yes" was assigned if the practice had been carried out either on the previous night or during the previous rainy season.

The univariate analysis examined associations between 11 hypothetically explanatory variables (Table 8-4, first column) and the following behaviour outcomes:

- *Use of any mosquito deterrence method*
- *Use of coils or aerosol sprays*
- *Use of bednets*
- *Use of sule*

Eight of the hypothesised exposure variables were continuous scales obtained through factor analysis and expressed in terms of quartiles. The rationale for this data transformation process is given in Chapter 6. The lowest quartile constituted the baseline group. Regarding the remaining variables, the oldest caretaker age group, youngest index child's age group and walls made of bare reeds constituted the baseline groups, respectively.

The mosquito deterrence practices were cross-tabulated with the hypothesised explanatory variables, and crude odds ratios (OR) with 95% confidence intervals were calculated (stratum-specific OR). While the passages summarising the results report stratum-specific OR between the baseline and the top strata for practical reasons, the summary table of the association between mosquito deterrence practices and the posited predictors (Table 8-4) shows Mantel-Haenszel odds ratios, with 90% CI and p values for the score test for trend.

c) Multivariate analysis

Following the univariate analysis, in order to identify independent predictors of each practice, 4 logistic regression models were fitted.

For each model, stepwise multivariate logistic regression procedure of backward fitting was carried out, as described in chapter 7 (section 7. 2. 3 . c). Adjusted trend OR with 95% confidence intervals were obtained through this procedure.

8.3 Results

8.3.1 Aspects of housing quality relevant to mosquito entry

Throughout the 3 rounds of household visits there were 149 opportunities to visit the index children's sleeping quarters in 88 households. Not surprisingly, no major variations were observed between the 3 rounds in terms of building materials for the index child's sleeping quarters, with the exception of 5 households where the walls in the index child's bedroom had been upgraded, within the course of the study, from reed walls with no fillings to reeds daubed with mud, or from reeds-with-mud to cement. The walls in the majority of the index children's sleeping quarters (83%) were made of reeds. Of these 60% were daubed either with mud or cement. In over 60% of the observed bedrooms, gaps in the walls were spotted in at least one visit. In all houses inspected from the inside, eaves spaces between the roof and the wall were seen.

Types of wall materials in the index child's room, in comparison to the main construction are given in Table 8-1. Sixty (68%) of these children slept in rooms in the same conditions as the main building. Of the remaining 28 index children's bedrooms, only 4 were worse off than the house's main building, specifically having slept in reed walled rooms in contrast to main buildings of reeds-with-mud.

Table 8-1: Construction quality of index children's sleeping quarters compared to the main building of the same house.

Wall structure in main building	Wall structure in index child's sleeping quarters			Total
	<i>Cement</i>	<i>Daubed</i>	<i>Bare reeds</i>	
<i>Cement</i>	13	0	0	13
<i>Daubed</i>	2	25	4	31
<i>Reeds</i>	0	22	22	44
Total	15	47	26	88

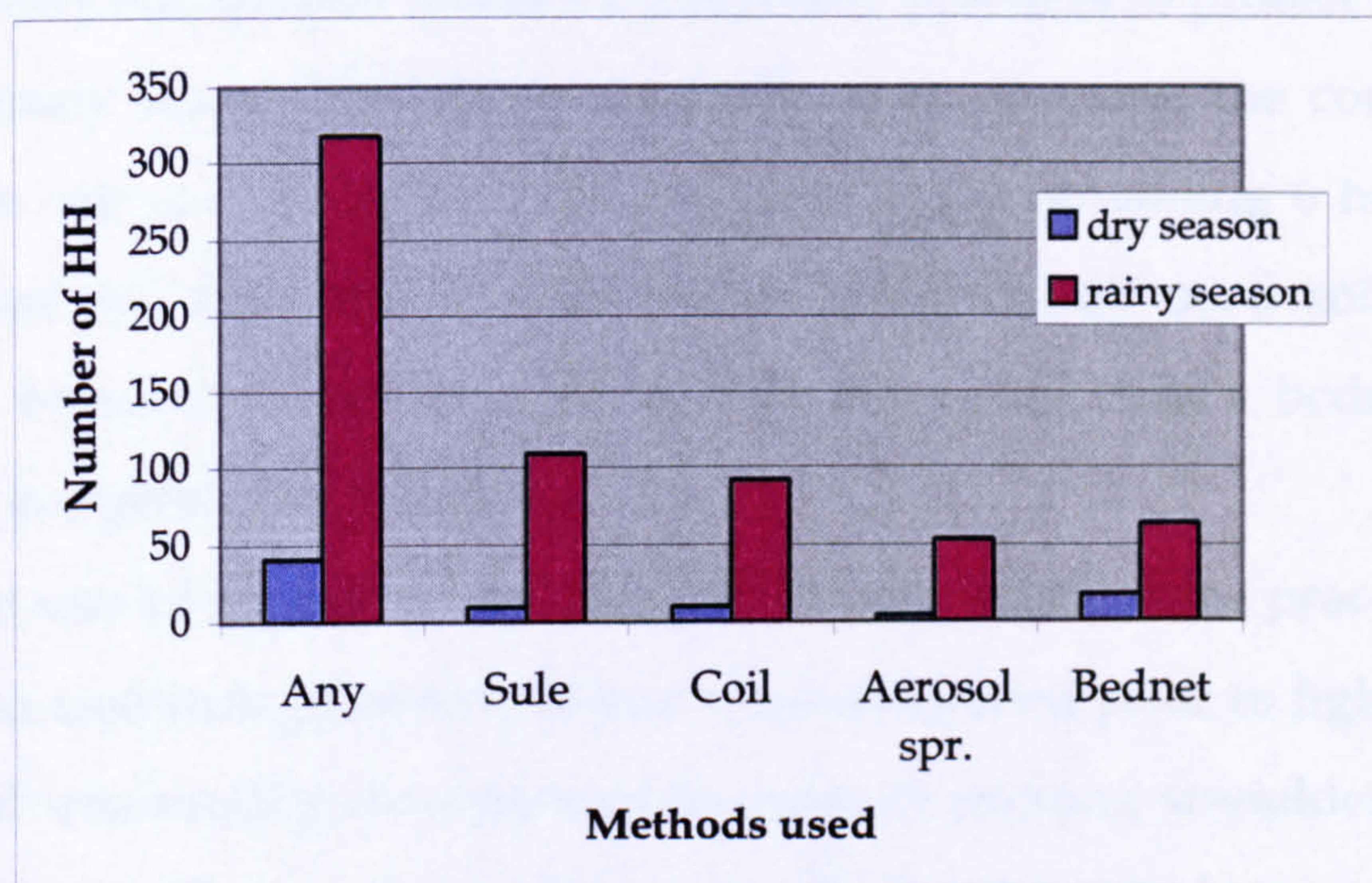
8.3.2 Types and variations of mosquito deterrence practices

Of the 405 surveyed households, 318 (79%) mentioned having used at least one method of protection against mosquitoes in the index child's bedroom during the year. Forty-one households (10%) had engaged in mosquito deterrence practices to protect the index child on the night prior to being surveyed, which was during the dry season.

The types of mosquito deterrence practices reported were fumigation of bedrooms with naturally available materials (locally referred to as *sule*), use of mosquito coils, aerosol sprays, and bednets³¹. This range of practices carried out in the index child's room was the same in both seasons. However the relative frequencies of such practices varied. It was noted that bednet use shifted from the single most used in the dry season to the second least used in the rainy season. *Sule*, the second most used method in the dry season became the single most used method in the rainy season. Figure 8-1 shows that while bednet use became nearly 4-fold higher in the rainy season, compared to the dry season, *sule* use increased 10-fold.

³¹ Bednets were virtually invariably ITNs. The use of ITNs was reported in only one household, which had used it both the dry and rainy season, and there was no indication of whether that net had still active insecticide at the time of the survey.

Figure 8-1: Mosquito deterrence methods used in index child's bedroom, with seasonal variations in the scale of their use.



There were slight differences in the engagement in mosquito deterrence practices among different bedrooms of single houses, as illustrated in Table 8-2. Of the 45 households reporting use of any mosquito protection method on the previous night, 23 did apply it to all bedrooms. Of those households not covering all bedrooms, 18 provided protection exclusively to where the index child had slept and 4 to sleeping quarters other than the index child's.

Considering the households where bednet use on previous night was reported ($n=17$), the picture was similar to that regarding use of any mosquito deterrence product (Table 8-2). In all these 17 households, the index child was reported to have slept under a bednet on the previous night. Additional bednet use by householders other than the index child was reported in 9 households (2%), and in all these households the index child had also slept under a bednet.

Table 8-2: Reported mosquito deterrence activity in index child's room on the previous night

Anti mosquito product	Index child and others	Exclusively Index child's room	People other than the index child
Any product ($n=45$)	23 (51%)	18 (40%)	4 (9%)
Bednet ($n=17$)	9 (53%)	8 (47%)	0 (0%)

A combination of more than one technique was reported in 20 (6%) of all households engaging in mosquito deterrence practices to protect the index child in the rainy season (n=318). In 14 (79%) of those cases, the combination was between *sule* and mosquito coils, and among the remaining 6 households half combined *sule* and aerosol sprays and the other half used coils and aerosol sprays. None of those using bednets in the index child's bedroom reported using a complementary method.

It was of interest to this study to obtain details of the practice of burning *sule*. The materials gathered for *sule* were moistened prior to lighting them and charcoal was usually incorporated in order to prolong smouldering. The most frequent immediate answer when respondents were asked to specify the type of material used for *sule* was: "Anything that burns for long will do". Because this practice was rare during dry season, data regarding *sule* use in the rainy season were used to provide insights into the types and relative frequencies of materials used to fumigate the index child's bedroom.

Table 8-3: Materials used for *Sule*, by those reporting *sule* use in the index child's room during the rainy season.

Burner materials	Freq. mentioned (%)
Crop residues	39 (36)
Leaves	16 (15)
Candle wax	10 (9)
Firewood residues/ wood pulp	11 (10)
Combination of materials	12 (11)
Unspecified	21 (19)
Total	109 (100)

As seen in Table 8-3, the majority of households that practiced fumigation (n=109) reported the use of crop residues. Though a wide range of *sule* materials was identified, the most frequent materials mentioned across the studied households were bran and cobs of *Zea mays spp* (maize), fruit husks and shells of *Cocos nucifera* L. (coconut) and *Anacardium occidentale* (cashew), fruit seeds of *Mangifera indica* L. (mango), and *Sclerocarrya birrea* (marula). Moreover a range of leaves were used, including those from the already mentioned fruit trees and of *Trichilia emetica* (Natal mahogany), and various types of grass.

Of the fraction of households reporting combination of materials, one had incorporated goat's dung, a type of material not mentioned by any other household.

8.3.3 Factors associated with mosquito deterrence practices

a) Any mosquito deterrence method used at some point during the year

As can be seen from Table 8-4 (second column), initial analysis showed that having engaged in any mosquito deterrence practice to protect the index child during the year was positively associated with higher scores in *HoH socio-economic status* and *Caretaker's educational status*. Children that were protected by any practice were 1.8 times more likely to belong to households in the highest quartile of *HoH socio-economic status* than to the lowest quartile (95% CI= 0.9- 3.4), and 2.3 times more likely to be from households in the highest quartile of *Caretaker's educational status* than the lowest (95% CI= 1.2- 4.4). On the other hand, *Caretaker's proximity to own family* was negatively associated with mosquito deterrence practice in the index child's bedroom at some point during the year. For this association, the OR between the top and the lowest quartile was 0.4 (95%CI= 0.2- 1.0).

Having included the above variables initially associated with using any mosquito deterrence practice in the index child bedroom in a logistic regression model, only *Caretaker's education* and *Caretaker's proximity to own family* remained independently associated with the outcome (Table 8-4, third column). In both cases the adjusted OR did not differ significantly from the crude OR.

This means that better educated women, and those living closer to their husband and distant to their own family, were more likely to protect their children against mosquitoes, independent of *HoH socio-economic status*.

b) Commercially available mosquito repellents (coils and aerosol sprays)

Having engaged in practices using commercially available mosquito repellents sometime during the year in the index child's room was positively associated with caretakers being in the highest quartiles of *Educational status*, and *Financial independence* scores (Table 8-4, fourth column). For these associations, the OR of carrying out this practice, between the lowest and highest quartiles of *Educational status*, and *Financial independence* were 2.1 (95% CI= 1.1- 3.7) and 1.5 (95% CI= 0.8- 2.7) respectively. These associations remained significant after multivariate analysis, suggesting that these variables were independent of each other in predicting mosquito coil and aerosol spray use in the index child's room.

Table 8-4: Univariate and multivariate analysis of predictors of ever carrying out mosquito deterrence practices protecting the index child

Predicting factors	Any practice (n=405)		Use of commercially available repellents (n=405)		Use of bednets (n=405)		Use of <i>sule</i> (n=405)	
	Crude OR [95% CI]	Adjusted OR [95% CI]	Crude OR [95% CI]	Adjusted OR [95% CI]	Crude OR [95% CI]	Adjusted OR [95% CI]	Crude OR [95% CI]	Adjusted OR [95% CI]
<i>HoH socio-economic status</i> [*]	1.26* [1.04-1.55]	-	1.06 [0.88-1.27]	-	1.65** [1.30-2.09]	1.61** [1.22-2.13]	0.80* [0.66-0.97]	-
<i>HH modern assets</i> [*]	1.12 [0.92-1.37]	-	1.13 [0.94-1.36]	-	1.70** [1.33-2.16]	1.72** [1.30-2.26]	0.59** [0.49-0.72]	0.56** [0.45-0.70]
<i>HH traditional assets</i> [*]	1.14 [0.93-1.39]	-	1.04 [0.86-1.24]	-	0.87 [0.69-1.11]	-	1.06* [1.02-1.53]	1.29* [1.04-1.60]
<i>CT educational status</i> [*]	1.24* [1.02-1.51]	1.26* [1.03-1.54]	1.31** [1.09-1.57]	1.33** [1.10-1.61]	1.35* [1.07-1.72]	-	0.70** [0.58-0.86]	-
<i>CT financial independence</i> [*]	1.11 [0.91-1.35]	-	1.20* [1.00-1.44]	1.22 [1.02-1.47]	0.97 [0.77-1.24]	-	0.96 [0.79-1.16]	-
<i>CT decision-making power</i> [*]	1.05 [0.86-1.27]	-	1.13 [0.94-1.36]	-	0.99 [0.78-1.26]	-	0.98 [0.81-1.20]	-
<i>CT proximity to own family</i> [*]	0.79* [0.65-0.97]	0.78* [0.64-0.96]	1.00 [0.83-1.19]	-	0.69** [0.54-0.88]	0.75* [0.57-0.98]	1.05 [0.86-1.27]	-
<i>CT exposure to information</i> [*]	1.21 [0.99-1.47]	-	1.18 [0.99-1.42]	-	1.40* [1.10-1.77]	-	0.79 [0.65-0.96]	-
<i>CT age group (years)</i> [†] >40, 30-39, 20-29, <19	0.97 [0.73-1.29]	-	1.21 [0.93-1.58]	-	1.30 [0.92-1.82]	-	0.67** [0.50-0.87]	0.70* [0.52-0.93]
<i>Index child's age group (months)</i> 0-11, 12-23, 24-25, >36	1.06 [0.87-29]	-	1.11 [0.93-1.34]	-	0.91 [0.71-1.16]	-	1.01 [0.83-1.23]	-
<i>Type of wall in index child's bedroom</i> [†] Bare reeds, daubed reeds, cement	1.21 [0.62-2.36]	-	1.31 [0.66-2.58]	-	0.83 [0.31-2.20]	-	0.96 [0.50-1.85]	-

*p<0.05

**p<0.005

^{*} Quartiles of scores obtained thorough factor analysis (Chapter 6)[†] Number of observations=403 due to missing data regarding caretaker's age[†] Number of observations=88 (number of bedrooms visited)Crude OR=Mantel-Haenszel odds ratio score test for trend, from univariate analysis
Adjusted OR= adjusted trend odds ratio, from multivariate analysis

c) Bednets

The likelihood of reporting the index child sleeping under a bednet increased 5.7 times in the highest quartile of scores in *HoH socio-economic status* (95% CI 2.2- 15.1) and 4.8 times in that of *HH Accumulation of modern assets* (95% CI 1.9- 12.1) compared to the baseline groups. The multivariate analysis showed that increased *HoH socio-economic status* and *HH accumulation of modern assets* remained significantly associated with bednet use by children after adjusting for the possible effect of the other variables in the model.

Three times more caretakers in the highest quartile of *Caretaker's educational status* (95% CI= 1.3- 6.9) and *Exposure to information* (95% CI= 1.2- 6.6) reported children under their care ever sleeping under a bednet over the recall period compared to those in the baseline group. The associations between *Caretaker's educational status* and *Exposure to information* and bednet use by children did not persist after adjusting for the other variables. This suggests that caretaker's education and information are so intercorrelated in their role as predictors of children's bednet use that neither could show an independent effect when added simultaneously to the model. The apparent crude association could also have been explained by wealth.

The univariate analysis showed that higher scores of *Caretaker's proximity to own family's* scores were associated with less tendency for the child under her care to have used a bednet (OR between the lowest and highest quartiles = 0.3, 95% CI= 0.1- 0.6). However the significance of the association decreased after the multivariate analysis, suggesting that wealth could be playing a partial role in explaining the advantage of being distal to own families.

d) Sule

Sule use was influenced by wealth variables in that households in the highest stratum of scores related to *HoH socio-economic status* and *Accumulation of modern assets* were respectively 2 and 6 times less likely to have used *sule* in the index child's bedroom.

Likewise, *Caretaker's exposure to information* and *Educational status* were inversely associated with *sule* use. With regards to *Caretaker's education*, households in the highest quartile were 4 times less likely to have used *sule*.

On the contrary, belonging to higher strata of *HH Accumulation of traditional assets* scores was positively associated with increased probability of having used *sule* in the index child's bedroom. The OR increased to 3.2 (95% CI= 1.5- 6.7) and 4.0 (95% CI= 1.9- 8.4) in the second and third quartile of *Accumulation of traditional assets* scores and decreased to 2.4 (95% CI= 1.2- 5.1 in the highest quartile.

The younger the caretakers were, the less likely were they to have engaged in this practice. Compared to caretakers 40 years and above, those that were under 20 years of age were 3 times less probable to report *sule* use (OR = 0.3, 95% CI= 0.1- 0.9). Similar stratum-specific odds ratios, in relation to the base line group, were observed in relation to the other two age groups.

The variables that remained significantly associated with *sule* use in the multivariate analysis were *Accumulation of modern assets*, *Accumulation of traditional assets* and *Caretaker's age*.

Table 8-5: Factors significantly associated with mosquito deterrence practices in the index child room

Predicting factors	Mosquito deterrence practice			
	Any deterrence practice	Sule	Commercially available repellents	Bednets
<i>CT education</i>	1.26 (1.03- 1.54) *		1.33 (1.10 -1.61) **	
<i>CT financial independence</i>			1.22 (1.02- 1.47) *	
<i>CT proximity to own family</i>	0.78 (0.64- 0.96) *			0.75 (0.57- 0.98) *
<i>CT age</i>		0.70 (0.52- 0.93) *		
<i>HoH socio-economic status</i>				1.61 (1.22- 2.13) **
<i>HH modern assets</i>		0.56 (0.45- 0.70) **		1.72 (1.30- 2.26) **
<i>HH traditional assets</i>		1.29 (1.04- 1.60) *		

*p<0.05

**p<0.005

Factors associated with the 4 aspects of mosquito avoidance practice to protect the index child are summarised in Table 8-5. These were the factors that remained significantly associated with such practices in the multivariate analysis. A discussion of the above associations and the descriptive results presented earlier in the chapter follows in the next section.

8.4 Discussion

8.4.1 Range of mosquito deterrence practices

Despite the fact that this study focused on mosquito deterrence practices covering children, whereas other studies in similar disciplines have investigated overall household mosquito deterrence practices, the repertoire of mosquito deterrence practices captured by this study is consistent with what was found in other parts of SSA. Taking into account practices carried out during the rainy season, where mosquito densities are highest, the relative frequency of the practices were consistent with what had been found in earlier

studies, having the most common practice been the burning of traditional smoky repellents, followed by use of mosquito coils and aerosol sprays and the least common the use of bednets. A country representative survey of malaria prevention measures in Malawian households found the same range of practices in the same order of importance (Ziba *et al.*, 1994).

Bednet use by children was found to be low, ranging from 4% in the dry season to 15% in the rainy season. The latter figure is in conformity with an overall median use of 15% by children under 5 across 30 African Nations (Monash 2004). However it is not known in which season those surveys were carried out, therefore this comparison should be interpreted with caution.

Although the study only focused on coverage of children under 5, there was some indication that usage levels by adults did not differ much from that of children. It can be inferred that this area is lagging behind many African settings where bednet coverage was estimated. High coverage in the Gambia and other west-African countries (e.g., Mali and Guinea Bissau), has been attributed to a high social and cultural value associated to the possession of nets. In the Gambia bednet use is built-in within the culture in such way that the production of UTNs has been incorporated into local markets and these bednets are preferred to the imported ones (Webster *et al.*, 2005). In Mozambique there are no accounts of locally produced bednets, and as in the rest of East and Southern Africa, the bednet culture is patchy and has only recently been imported through aid and social marketing projects (Hanson *et al.*, 2003; Mushi *et al.*, 2003; Schellenberg *et al.*, 1999; Schellenberg *et al.*, 2001; The Netmark Project, 2001). Tanzania is an exception, where bednet coverage increased in the 1990s and sustainability of increased ITN coverage has been consolidated by social marketing (Kikumbih *et al.*, 2005; WHO/UNICEF, 2003).

In terms of ITN use by children, the very low rate (0.2%), corresponding to 1 household, is also in line with what was seen in most African countries, where the overall median use by children under 5 was estimated at 2% (Monash 2004), which is far below the stipulated target of 60% by 2005 (Roll Back Malaria 2002).

With regards to the use of traditional repellents, the repertoire of materials used differed in some ways to what had been reported elsewhere. For example animal dung was not a common material used for fumigation in this setting compared to Malawi (Ziba *et al.*, 1994), Kenya (MacCormack, 1984), South Africa (Govere *et al.*, 2000), Ghana (Gyapong *et al.*, 1996), and Zimbabwe (Lukwa *et al.*, 1999). In terms of types of plants used, no pattern of specific plants chosen was identified. The materials used are not known to have particular aromatic properties, as opposed to findings in other malaria endemic areas in West Africa and elsewhere, where the burning of aromatic plants such as eucalyptus (*Eucalyptus spathulata*) and neem (*Azadirachta indica*) is employed (Aikins *et al.*, 1994; Aikins *et al.*, 1993; Dgedge, 2000; Gyapong *et al.*, 1996; Lukwa *et al.*, 1999).

Despite the low bednet coverage rates, and the virtually non-existent ITN usage, through these data it is possible to see that in the majority of households, mosquito deterrence seems to be amongst the actions that households incorporate in their HHEH repertoire of practices. However there are still one fifth of households that do nothing.

Thresholds in perception of mosquito density and economic constraints could jointly be playing a role in determining the prevalence and variety of mosquito deterrence practices in Manhica, as discussed in the sections that follow.

8.4.2 Seasonality in mosquito deterrence practices

Engagement in mosquito deterrence practices in the index child's bedroom in the dry season was reported in 10% of the households. However, reporting on mosquito avoidance practices in the previous rainy season revealed that 79% of households had used any anti-mosquito product to protect the index child, suggesting the element of seasonality playing an important role in determining such disparities in rates of mosquito deterrence. With regard to bednet use, it was found here that only 27% the households where the index child had slept under a bednet reported doing so in both seasons. This finding

is in agreement with earlier findings from five West African countries (Aikins *et al.*, 1994), where with the exception of Ghana bednets were reported used exclusively in the rainy season. However, compared to other practices, bednets were the single most likely method to be used by children on both seasons in the present study.

The most common immediate stated reason for this seasonal shift in behaviour was the increment in the quantity of mosquitoes in the rainy season compared to the dry season. This explains why people increase net use in the rainy season but not entirely why they stop using them in the dry season. However, if in this study area malaria transmission persists at some level throughout the year (Marques *et al.*, 2005; Saute *et al.*, 2003), then it is a problem if the main cue to increase mosquito deterrence practices is mosquito density. In fact, the risk of malaria at the end of the rainy season goes down slowly compared to the decreasing rates in the levels of nuisance (J.D. Lines, personal communication.), therefore people might stop worrying about mosquitoes too soon before malaria transmission peaks disappear.

The marked variations in mosquito avoidance practices across seasons means that, should more effective means of mosquito deterrence practices to protect children be promoted in an area such as Manhiça where transmission is perennial, emphasis on all-year round use is crucial. However, the fact that 27% of the bednets were still being used during the dry season offers some encouragement with regards to potential acceptability of the emphasis on all year round bednet use.

8.4.3 House design

The indicator used for house design in this study was wall materials. In this study 80% of the houses were classified as poorly constructed, mostly made of reeds or daubed reeds. Poorly constructed houses were demonstrated to harbour significantly higher number of indoor-resting mosquitoes compared to well built houses in Sri Lanka (Gunawardena *et al.*, 1998). Moreover, gaps were found in walls of most of the poorly constructed houses and eaves spaces were

very common across all types of construction. Similar circumstances have been documented elsewhere in relation to increased risks to malaria (e.g., Gunawardena *et al.*, 1998; Hagmann *et al.*, 2003). Nonetheless, in this study, important differences were found in the quality of construction among structures of single households. Most importantly it appears that in this setting, children under five are likely to benefit from house improvements, as it was found that 27% of those children were likely to have slept in better, 68% in equal, and only 5% in worse quality building conditions compared to the main building.

While constituting potential risk to mosquito entry, gaps and eaves spaces can be useful in places where cooking involving incomplete combustion of biomass fuels takes place indoors. In rural Kenya, improved ventilation through the opening of eaves spaces and incorporation of windows on walls were important components of interventions to reduce exposure to indoor air pollution (Warwick & Doig, 2004). Indoor air pollution from low-grade fuels is a risk factor for acute respiratory infection in children (Smith *et al.*, 2000). This opens suggestions to the inquiry of whether the use of smoke repellents, which also uses biomass materials such as firewood and charcoal, should require gaps or eaves spaces to remove the smoke from the rooms. No evidence exists to support the idea that these smokes cause IAP to the extent that biomass cooking fuels can do. In this study 85% of the surveyed households reported using firewood for cooking, and during the rainy season 43% cooked either in the living room or a bedroom. This is the season where the use of smokes to deter mosquitoes peaks.

Therefore technical fixes to solve the problem of vulnerability to mosquito entrance have to take the problem of indoor air pollution into consideration. Similarly, reducing indoor air pollution through ventilation needs to consider permeability to mosquito entry.

8.4.4 Protection of children under 5

All households using bednets on the previous night did not exclude the index child. Regarding all other mosquito avoidance products they were allocated exclusively to bedrooms other than the index child's in only 0.7% of the households. This could either mean that children less than 5 years of age were prioritised or that it happened that in most cases these children were sleeping in the same quarters or sharing beds with the prioritised people.

These findings differ from what has been found elsewhere. For example, Aikins and colleagues (1994) found that older people were more likely to use bednets than younger people. However, the subpopulation analysed did not include children. Those authors found it difficult to investigate children's sleeping arrangements on the grounds that parents would give biased responses. In Kenya the probability of use of ITNs distributed free of charge was lower in children under 5 compared to adults (Alaii *et al.*, 2003b). A parallel problem was identified in the rural district of Boane, in Southern Mozambique (Dgedge, 2000), where people already using ITNs reported having given priority to breadwinners. Likewise in Uganda it was revealed that primary protection by bednets was not directed at children under-5, suggesting that children used bednets because they happened to share beds with parents (Mugisha & Arinaitwe, 2003).

On the other hand, despite confirming that in general not all mosquito nets owned by Sub-Saharan African households were being used by young children (Korenromp *et al.*, 2003), marked differences across countries were detected and remarkably concordant with the present results, as Mozambique was one of the countries in that review where proportions of adults and children under 5 sleeping under a net did not differ (Korenromp *et al.*, 2003). Those data on Mozambique, similar to the present study, were regarding practices in the dry season, therefore cannot tell us whether the unobserved differences between children under 5's bednet use and adults' are true in the rainy season.

8.4.5 Factors associated with mosquito deterrence practices to protect children under 5

None of the wealth variables did independently predict ever engaging in any type of anti-mosquito practice to protect the index child, because not only the richest households engaged in those practices. What played a role in distinguishing those that did nothing from the rest of the households were two characteristics of the caretaker: *Proximity to own family* and *educational status*.

First, increasing scores of *Caretaker's proximity to own family*³² were associated with decreased likelihood of engaging in mosquito deterrence practices. This did not conform with the hypothesis that caretakers living closer to their mothers or other relatives could benefit from better care-taking advice and support with ultimate benefits to child health. Instead, caretakers living with a partner and away from maiden families were more likely to carry out mosquito avoidance practices that covered the child under care. Being married and away from the maiden family is a characteristic that could be associated with the age of the principal caretaker, or with the mere fact that she had an extra source of income which is the spouse's. The first possibility was ruled out because age did not distinguish users from non-users. Likewise none of the income-related variables predicted this practice.

Increased *Proximity to own family* scores suggests that those caretakers living with their maiden family were most likely part of an extended family where their own presence and their bearing of at least one child could be in itself an extra burden to the whole family, positioning them lowly in the household hierarchy of prioritised people. In these circumstances the caretaker may not have means to provide favourable HHEH conditions to her child. Other children, such as the caretaker's brothers' might be more prioritised because according to patrilocal rules, they "belong" to that family (i.e., bear the family name), and offspring of the most likely bread winners (i.e., male in the productive age). On the other hand, women living with their partners, away

from the maiden families are most likely to be at the centre of a nuclear, more stable family where their husbands are the heads of household, and the management of household resources towards protection of their own offspring becomes more within her reach. Even if their husbands' families are extensive, their children, who belong to the husband's family are not overlooked (Arnfred, 2001). There is documentation of differential child care and survival associated with marital stability and child legitimacy in sub-Saharan Africa, which is viewed as neglect (e.g., Meekers, 1994). This is one explanation which suggests that increased likelihood that children are covered by mosquito deterrence products results from deliberate action.

Alternatively, protection of children by mosquito deterrence practices could be fortuitous, in that those caretakers who live with their husbands are more likely to draw the child closer to the breadwinner at bedtime due to the three of them sharing a bed or bedroom. In such circumstances, the child becomes more prone to being covered by a mosquito deterrence practice which is actually being directed to the mother's partner. In contrast, caretakers, and their children, living with their own family are less likely to be sharing a bed or bedroom with the principal breadwinner. In Uganda, children of married women and those living with a partner were 4 times more likely to sleep under bednets compared to offspring of women who had never married, which has led to the conclusion that bednets were primarily for the protection of their mothers' partners (Mugisha & Arinaitwe, 2003).

The second predictor of having used any mosquito deterrence practice to protect the child was *caretaker's educational status*. This could mean that having carried out any mosquito deterrence practice was dependant on caretaker's awareness of the threat posed by mosquitoes. In this way, influences of education on health beliefs and knowledge cannot be ruled out as principal drivers for mosquito avoidance. The best indication for this suggestion is the fact other characteristics which had been suggested to be associated with

³² As discussed in Chapter 4, having a high family networks' score signified living close to maiden family members but being less likely to cohabit with a partner.

education and to endow women with the capacity to carry out health preserving practices (United Nations, 1985; Ware, 1984) were not proved important predictors of engaging in mosquito deterrence practices. These characteristics were *Exposure to information*, *Decision-making power*, *Financial independence*, and *Wealth*.

In terms of predictors of the use of specific products, the findings indicate that HoH characteristics were specifically linked to bednet use by children, similar to studies on household bednet possession in association with HoH education (Howard *et al.*, 2003; Nuwaha, 2001). Further, households wealthy enough to have accumulated modern goods were the most likely to have had children under 5 sleeping under bednets. This seems plausible, since a bednet in itself can be considered a modern asset, and that possession of bednets showed a linear correlation with use of bednets by children in sub-Saharan Africa (Korenromp *et al.*, 2003). It should also be remembered that radio possession was one of the items contributing to the *Modern assets* composite score. A country representative survey on ITNs in Mozambique, revealed that 59% of those with information about malaria had heard the information through the radio (The Netmark Project, 2001). Therefore, the association with this variable could have been explained by increased *Exposure to information*, which also showed a crude association with bednet use in the present study.

Socio-economic characteristics of the HoH did not predict the use of coils and sprays in the index child's bedroom. Instead, the use of these products was predicted by analogous characteristics of the caretaker: increased levels of *Educational status* and *Financial independence*, which is indicative that the purchase of coils and sprays might be in the responsibility of women and therefore reflect on their decision on when and where to allocate the use of those products. Further, although costly on the long run, these products do not incur large outlays that would have otherwise been in the domain of the head of household.

Use of *sule* was strongly predicted by decreasing levels of *Household accumulation of modern assets*, which suggests that wealthier households are more likely to refrain from using traditional methods, and more inclined to use modern ones. In fact, Table 8-5 shows that household wealth variables were those that marked the contrast between *sule* users and bednet users, and that *Caretaker's education* did not show the same effect. This finding runs in contrast with the suggestion from data in Bangladesh with regards to hygiene practices that entailed the use of modern products (Lindenbaum *et al.*, 1989). Those authors found that educated women emulated modernised behaviour styles of the elite such as not bathing in rivers or canals and using tubewell water for those purposes, in contrast with uneducated women (Lindenbaum *et al.*, 1989). Less pursuit of costless practices could not necessarily be reflective of the wealthier being able to afford costly options, but perhaps an indication that by choosing a costless mosquito deterrence practice, a lower social status might be conveyed to the peers, particularly if the practice is less pleasant and perceived to be less effective (see Chapter 10).

The fact that decision-making power had no importance suggests there being no conflicts of interest in mosquito deterrence practices to protect children. This can explain why a privileged bargaining status amongst householders did not make a significant difference in the outcome of pursuing or not mosquito avoidance practices specifically to the benefit of children.

These circumstances contrast treatment seeking behaviour scenarios, from which most hypotheses held in this study were drawn. Treatment seeking behaviour is often the response to a strong stimulus, which is child illness episode. The situation often requires caretakers to take action and often the most autonomous caretakers successfully pursue desirable treatment (Lindenbaum *et al.*, 1989; Sykes *et al.*, 2003). In such circumstances it is perceptible how decision-making power of the caretaker might have a significant influence on the behaviour outcome. This contrast between the active role of the caretaker in the context of treatment seeking, and the lack of strong stimuli, hence less conflicts of interest in the scenario of HHEH

preventive practices, supports the possibility that the mosquito deterrence practices here investigated were not carried specifically in order to primarily guarantee the survival of children under 5, but that benefits were incidental.

8.5 Conclusion

This chapter examined the extent to which caretakers protect their children against mosquito bites and gave a detailed account of the alternatives of products existent and in use, different from many earlier studies that give an account on product possession only, most concentrating on bednets (Agyepong & Manderson, 1999; Aikins *et al.*, 1993; D'Alessandro *et al.*, 1994; Dgedge, 2000; Howard *et al.*, 2000; Nuwaha, 2001).

Mosquito deterrence has been attempted by most households in the study population, and as in the case of household sanitation, people devote resources locally available for the purpose. Different forms of mosquito deterrence practices were captured, and it was concluded that burning of traditional smoke repellents were the most common. ITN use, the proven most effective household-level mosquito deterrence practice was not common.

It emerged in this chapter that wealth factors were held accountable for mosquito deterrence practices when these were carried out at some financial cost. Bednet use by the index child was dependent on the socio-economic characteristics of the head of household, while coils and aerosol sprays on the socio-economic characteristics of caretakers, giving a clear indication of different roles played by different householders in the acquisition and allocation of different products within the home.

There is suggestion of another important individual factor, *caretaker's proximity to own family*, playing a role in predicting *bednet use* and the *use of any deterrence product*. This was a key discovery, which can help identify children that are less likely to benefit from household level efforts towards mosquito deterrence, hence more prone to contract disease if the methods are effective

against malaria. These children are those that most probably have an illegitimate father, as their mothers reside with their maternal relatives hence less likely for the mother or the child to share a bed or bedroom with a male adult - the likely primary benefactor and beneficiary of mosquito deterrence product use.

Further, there were a few households that used anti-mosquito products throughout the year. These results highlight the importance of taking into consideration the seasons in which data is collected. Findings like this raise serious implications when it comes to the promotion of more efficacious malaria preventive methods such as ITNs, as the marked seasonal differences in mosquito avoidance efforts may limit the sustained effectiveness of such methods. This limitation in the promotion of bednets was also identified by Korenromp *et al.* (2003), as well as by Aikins (1993).

Issues needed to be addressed concerning finding the balance between existing practices to deter mosquitoes and control of indoor air pollution were raised by this study. Specifically despite the fact that, in concordance with many studies, it was found that smoke repellents constitute the most common practice to deter mosquitoes, it is not known to what extent these smokes contribute to overall indoor air pollution that is harmful to children. If that is true, serious considerations must be taken into account. For instance, it is currently recommended that drying fuel wood before use improves combustion and decreases smoke production, and that keeping young children away from smoke reduces exposure of this most vulnerable age group to health-damaging pollutants (Bates *et al.*, 2001), which is precisely the opposite of what is observed in rural households facing mosquito nuisance: they moisten the fuels to prolong combustion and use them in children's bedrooms.

Important implications can be drawn from these findings: First, if bednets for children are to be promoted, heads of households must be an important target group to sensitise. Second, if selective targeting is to be put in place, this study suggests that children from single mothers living in their original families should be a considered priority group to benefit from

programs involving subsidised or free distribution of anti-mosquito products. Finally, messages should emphasise use of anti-mosquito products throughout the year, and monitoring coverage rates should take place in both rainy and dry seasons.

Chapter 9 Clustering of hygienic practices

Chapter summary

This chapter is divided into 4 sections. The introduction gives a justification for the interest in investigating the phenomenon of clustering of HHEH practices, and a brief review of existing evidence to suggest such phenomenon. Following the introduction is the methods section, which gives an account of the variables selected and the approach used for the analysis (Principal Components analysis). The results section follows, which first focuses on the distribution of households according to the number of protective practices they tended to engage in, irrespective of the nature of the practices. It then moves to presenting the findings on how the practices cluster. The final section is the discussion of the results and implications for hygiene promotion.

9.1 Introduction

Children living in the most vulnerable conditions in sub-Saharan Africa are often simultaneously exposed to multiple infectious disease risks, implying that teasing apart and measuring public health significance of different protective practices to one single health problem is not simple. Particularly, with regards to single hygiene and sanitation practices, doubts have been raised as to whether the observable effect of one aspect of HHEH on diarrhoea can be really attributable to such aspect alone or in combination with other aspects (Curtis, 1998; Strina *et al.*, 2003), since hygiene and sanitation practices are held to be highly correlated among each other.

Outside the field of EH, there is the suggestion that health-related behaviours are not singly randomly distributed in individuals. Instead, in certain individuals, risk practices tend to coexist, and, similarly, clustering of protective behaviours has been demonstrated in particular individuals. Such evidence is more prominent in the field of non-communicable health problems. For example, tendencies towards physical training, seat belt use, dental hygiene, and healthy diet have been shown to interrelate in a systematic fashion (Røysamb *et al.*, 1997).

Attempts to empirically demonstrate that environmental conditions and practices correlate are scarce. Clustering among HHEH practices could be found in 5 studies, namely in Viet Nam (Dearden *et al.*, 2002), South Africa (Westaway & Viljoen, 2000), Bangladesh (Alam *et al.*, 1989), and Botswana (Kaltenthaler & Drasar, 1996a) at household level, and Brazil (Milroy *et al.*, 2001) at community level.

Different reasons led the authors of those studies to investigate such clustering patterns. In two cases cluster investigation was performed as a stepping stone towards the development of one or more behaviour scales or indices (Alam *et al.*, 1989; Kaltenthaler & Drasar, 1996a), as a parsimonious approach to studying the relationship between attack rates of diarrhoea in children and a wide range of hygiene behaviours, with no further query into the clustering phenomenon observed. In Botswana it was found that certain behaviours were always clustered so that families with one or two hygiene characteristics were likely to have others (Kaltenthaler & Drasar, 1996b). Those practices were put into a hygiene scale and childhood diarrhoea morbidity from households with low scores was compared to that in households with high scores.

Similarly, in rural Bangladesh, it was found that mothers who followed one type of practice were more likely to pursue other hygiene practices (Alam *et al.*, 1989). However in that study, the elements comprising the behaviour clusters found were not specified. Households were assigned to different risk groups according to the number of protective practices they engaged in (which

ranged from 1 to 4), and diarrhoea morbidity was compared across such risk groups.

Categorisation based on composite sanitary conditions to reflect the presence or absence of sanitary infrastructure elements that contribute to environmental health quality of area of residence was successfully carried out in Brazil (Milroy *et al.*, 2001). However, different from the above-described studies and the present study, that study focused on sanitary conditions of the public domain, and not the domestic.

Not only did the range and type of variables involved in the analyses of HHEH practices clustering differ, but also the methodologies used to collect and analyse the data varied substantially across the existing studies on this topic, as can be seen from Table 9-1. All household studies included aspects of hand-washing, and all but one investigated water use. However they did not converge in the parameters used to measure these practices.

For example, while Westaway and Viljoen (2000) and Alam *et al.* (1989) used directly observed occurrences of hand-washing after key events, Kaltenthaler and Drasar (1996a) used a proxy consisting of fingertip faecal coliform counts. Dearden and colleagues on the other hand based their hand-washing data on reported behaviour (Dearden *et al.*, 2002). Regarding water, the disparity in the aspects being studied was even larger. While two studies focused on water supply, particularly looking at water source type (Alam *et al.*, 1989) and distance to the home (Kaltenthaler & Drasar, 1996a), one study investigated water storage conditions (Westaway & Viljoen, 2000).

Moreover, a number of practices did not feature in all studies. Particularly, "faeces in the yard" featured in only two studies, and each of the remaining variables, namely "yard sweeping", "animal management", "bathing", and "food and utensils hygiene", were included in only one study. Therefore there are still no grounds for comparison among the existing studies providing evidence for clustering of HHEH.

Table 9-1: Summary of studies where clustering of HHEH aspects was investigated

Reference	Setting	Practices investigated	Methods	Results
Alam <i>et al.</i> (1989)	Bangladesh	<ul style="list-style-type: none"> • Source of washing water • Faeces in yard • Hw before serving food • Hw after defecation 	<ul style="list-style-type: none"> • Observed behaviours through weekly visits, during 1 month in the dry season, on 3 consecutive years • No details of observation technique • Number of practices clustering, rather than type of practices was investigated 	<ul style="list-style-type: none"> • 6% of HH did not carry out any positive practice • 20% carried out only one practice • 28% performed combinations of any 2 hygiene practices • 30% performed combinations of 3 • 17% carried out all 4.
Kaltenthaler, Drasar (1996a)	Botswana	<ul style="list-style-type: none"> • Compound condition (debris; sweeping) • Faecal coliforms on cloth, plate, and caregivers' fingertips • Water source distance • Animals in kitchen • Faeces in compound • Toilet possession and cleanliness • Children's fingertips, and drinking water faecal coliforms 	<ul style="list-style-type: none"> • Spot observations • Approach to detect clustering not specified 	<ul style="list-style-type: none"> • The first 5 behaviours (on the list in column 3) seemed to cluster. • No measures to indicate to what degree they clustered
Westaway, Viljoen (2000)	South Africa	<ul style="list-style-type: none"> • Hw after urinating, defecating, children's stools, cleaning bottom • Hw before eating, preparing food • Bathing daily • Covering food • Cleanliness of eating utensils • Covering of water container 	<ul style="list-style-type: none"> • Reported behaviours through questionnaire • Principal components analysis 	<ul style="list-style-type: none"> • Two components emerged: personal hygiene and domestic hygiene • Covering of water container did not form part of any cluster

Table 9-1 (continued)

Reference	Setting	Practices investigated	Methods	Results
Milroy <i>et al.</i> (2001)	Brazil	<ul style="list-style-type: none"> • Housing type • Pavement quality • Water supply system maintenance • Sewage disposal • Drainage system functionality • Residual solids collection 	<ul style="list-style-type: none"> • Detailed evaluation of sanitary infrastructure in the streets through questionnaire • Principal components analysis 	<ul style="list-style-type: none"> • 3 components identified: overall quality of infrastructure, residuals solid management, and coverage by public water systems.
Dearden <i>et al.</i> (2002)	Viet Nam	<ul style="list-style-type: none"> • Feeding child positive deviant foods • Feeding child during diarrhoeal disease episode • Washing child's hands before meals • Taking child to the health centre when ill 	<ul style="list-style-type: none"> • Open ended questions to caregivers of young children in 3 different communes • Participants divided into "doers" and "non-doers" according to their answers 	<ul style="list-style-type: none"> • Nearly all engaged in at least 1 positive behaviour • 1/3 practiced a single positive behaviour • over 1/2 practiced 2 or 3 behaviours • 10% practiced all 4 positive behaviours • Caregivers of one particular commune were significantly more likely to practice multiple positive behaviours compared to the other 2 communes.

Without having attempted to investigate clustering of HHEH practices, other authors found correlations between environmental health practices which had no a priori direct causal relationships (Curtis *et al.*, 1995; Hoque & Islam, 1995; Strina *et al.*, 2003). Strina's results in Brazil showed that households predisposed to possess adequate excreta disposal technology were also likely to perform better hygiene behaviours, not necessarily linked to use of excreta disposal technology, compared to those not possessing latrines (Strina *et al.*, 2003). Curtis *et al.* (1995) found that women with taps in the courtyards were more likely to engage in safe disposal of children's stools in Burkina Faso. Hoque's study (1995) showed that both use of improved water source and possession of latrine were predictors of thorough hand-washing among women in households of rural Bangladesh. Finally, it was shown in Viet Nam that

provision of nutritious diets to children was significantly correlated with washing children's hands before meals (Dearden *et al.*, 2002). Such relationships among practices that are apparently not directly related to one another could be explained by the clustering trends that this chapter intends to investigate.

If it is possible to ascertain that households that manage to put one environmental health practice in place are more inclined to also follow other practices, and to determine which practices generally tend to co-vary, then the concept model of HHEH in terms of the way in which its domains are organised and inter-related can be re-visited and this model can become more useful in terms of its practical implications when it comes to HHEH promotion for households.

9.2 Methods

9.2.1 Variables

Clustering of HHEH behaviour items was assessed using data obtained from the socio-economic and demographic questionnaire, spot observations and structured observations (as presented in Chapter 4, sections 4.5.1, 4.5.3, and 4.6.3). Nine HHEH items most commonly observed were measured as listed:

- Latrine drop hole with a lid in place
- Latrine slab and floor free of faecal matter
- Faeces not seen in yard
- Child's stools or soiled materials disposed of in latrine
- All drinking water vessels covered
- Hands washed after all critical events defined by the observation schedule
- All kitchen utensils placed off the floor

- Yard with traces of having been swept
- Engaged in any mosquito deterrence practice to protect the index child

9.2.2 Data Analysis

First, a frequencies table was generated, which grouped households according to the number of protective practices they performed at least once. For this analysis, behaviour outcome variables were coded as "Ever" or "Never". "Ever" was assigned to those households where the number of times the protective behaviour had been seen carried out was > 0 , whereas "Never" was assigned to those households where the number of times was $=0$. With regards to the only reported behaviour, mosquito avoidance in the index child's bedroom, "Never" was to those households which reported never engaging in use of any anti-mosquito product and "Ever" to those that reported using it at least once. Households where the opportunities to observe or report the 9 behaviours did not occur were excluded from the analysis.

In order to assess the clustering, Principal Components Analysis (PCA) was performed on the 9 candidate variables, using SPSS for windows, version 12.0.1 (SPSS Inc., 2003). Variables regarding observed hygiene and sanitation were expressed on a percentage scale that measured the share of occasions where the protective practice was observed in each household, given the number of opportunities there were for observation of such practice, to reflect the consistency and extent to which they might contribute to positive environmental conditions in the household. For such variables, the scales did not require standardisation because they were continuous and expressed in similar units (percentages). Differently, the variable regarding mosquito avoidance practices in the index child's bedroom, which relied on questionnaire responses, was categorical. For standardisation purposes, a 3-point proxy scale was created, equivalent to whether mosquito avoidance techniques were applied throughout the year, on one season only, or never, respectively.

A solution with orthogonal (VARIMAX) rotation of the principal components matrix was employed for the examination of co-variance of HHEH items. Each variable correlating with at least one component, with a loading equal to or above 0.30, was held as being correlated with that component. Cross-loaders and non-loaders were removed from the model and, in a stepwise fashion, the analysis was re-run after removal of each of those ambiguous variables. Alternative solutions were examined and interpretation was based on examination of the factor loadings in the final solution. Details of this procedure are given in Chapter 6.

In order to explore how the HHEH components distribute amongst the studied households and whether there are distinct groups of households with similar HHEH tendencies, each household obtained a score for each component. Therefore, households with higher tendencies of practising all the strong items of one component should have higher scores, compared to those with fewer tendencies. The scores on the components were represented on a scatter plot.

9.3 Results

9.3.1 Number of practices the households tend to follow

Households were grouped according to the number of positive practices they reported or had ever been seen performing.

None of the households included in the analysis had performed only one or none of the 9 protective practices. Likewise, none of the households had ever performed all nine behaviours positively. The majority had performed 5 to 6 protective behaviours and a small minority had ever carried out 3 and 8 positive behaviours respectively (Table 9-2).

Table 9-2: Households grouped according to number of protective behaviour outcomes ever observed/reported performing

Total number of practices carried out	Number of HH (n=63)³³
None	0
One only	0
Any combination of two	3
" three	8
" four	5
" five	17
" six	20
" seven	7
" eight	3
All nine	0

9.3.2 Principal component analysis of behaviour outcomes

a) The nature of the HHEH components

Information was retained for a total of 63³³ data points representing households that had been visited at least twice and had complete data for all items of analysis. Analysis was also run using 104 data points, corresponding to all households where structured observation occurred including those with missing values on certain variables. The solutions of both sets of data were very similar.

Two principal components, representing clusters of HHEH practices were generated in the analysis and were accountable for the total variance of 41%. The first principal component (PC1) accounted for 24% of the total variance, and PC2 accounted for 17%.

The factor loadings, shown in Table 9-3, represent magnitudes of correlation between each HHEH practice and one of the principal components. In PCA, the square of the correlation coefficient is equivalent to the proportion

³³ 63 data points representing households that had been visited at least twice and had complete data for all items of analysis.

of the candidate variable's variance explained by the principal component to which the variable is correlating.

Table 9-3: Factor loadings and percentage of variance explained by factor analysis of relationships amongst distinct environmental health practices in the households

Variables	Components and loadings	
	PC1	PC2
Latrine slab and floor free of faecal matter	.581	.201
Latrine drop hole covered with a lid	.594	-.094
Child's stools or soiled materials disposed of in latrine	.605	.021
All water vessels covered	.600	-.187
Hands washed after critical events	.448	.116
Yard with traces of having been swept	.211	.715
Placement of kitchen utensils off the floor	-.176	.764
Total variance explained	24%	17%

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Rotation converged in 3 iterations.

PC1 comprised 5 variables with loadings over 0.30. It was labelled *avoiding dirt* because the elements of this component were related to removal of stools from the environment, getting rid of faecal material and/or dirt from hands and preventing matter from getting into drinking water through safer storage practices. Child stools isolation, protection of stored water, cleanliness of latrine slab and floor, and covering of latrine drop hole were stronger predictors of this component than was hand-washing.

PC2 was labelled *order in the yard* due to the fact that it was inclined to express not only the cleanliness but also the organisation of the yard. Both variables comprising PC2, namely "yard with traces of having been swept", and "placement of all kitchen utensils off the floor", strongly influenced this component.

Figure 9-1 illustrates the spatial distribution of the variables with relation to one another, showing that the two clusters, above described, are evident.

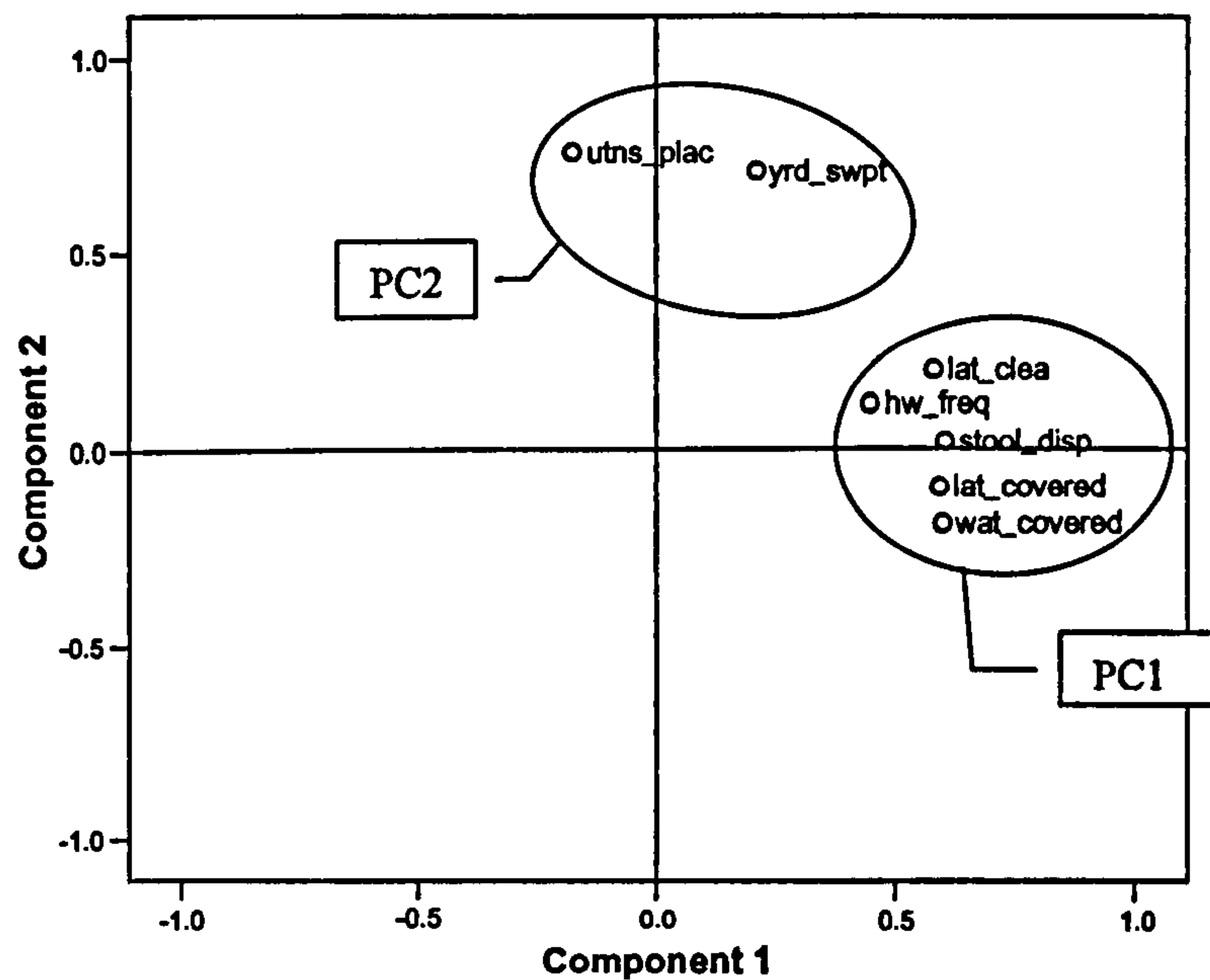


Figure 9-1: Spatial representation of PC1 and PC2, and the relative position of their respective HHEH elements.

b) Adequacy of the solution

As seen in Table 9-4, from the set of distributions of the final candidate variables for the analysis, the KMO measure of sample adequacy was 0.6, which is considered appropriate, as a minimum of 0.5 is required (Dziuban & Shirkey, 1974). The Bartlett test, which measures multivariate normality of the set of distributions, showed a borderline significant value, rejecting the null hypothesis that no relationships exist between any of the 7 variables, which means that the matrix derived from the data should be adequate for extraction (Ferguson & Cox, 1993).

Table 9-4: KMO and Bartlett's Test for the candidate set of data on HHEH clustering

Test	Test Statistic	df	Significance
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.6*		
Bartlett's Test of Sphericity	Chi ² = 30.930	21	0.04

*Note: Keiser's scale is divided into 6 levels, from >0.9 (close to perfect correlation) to <0.5 (perfectly uncorrelated)

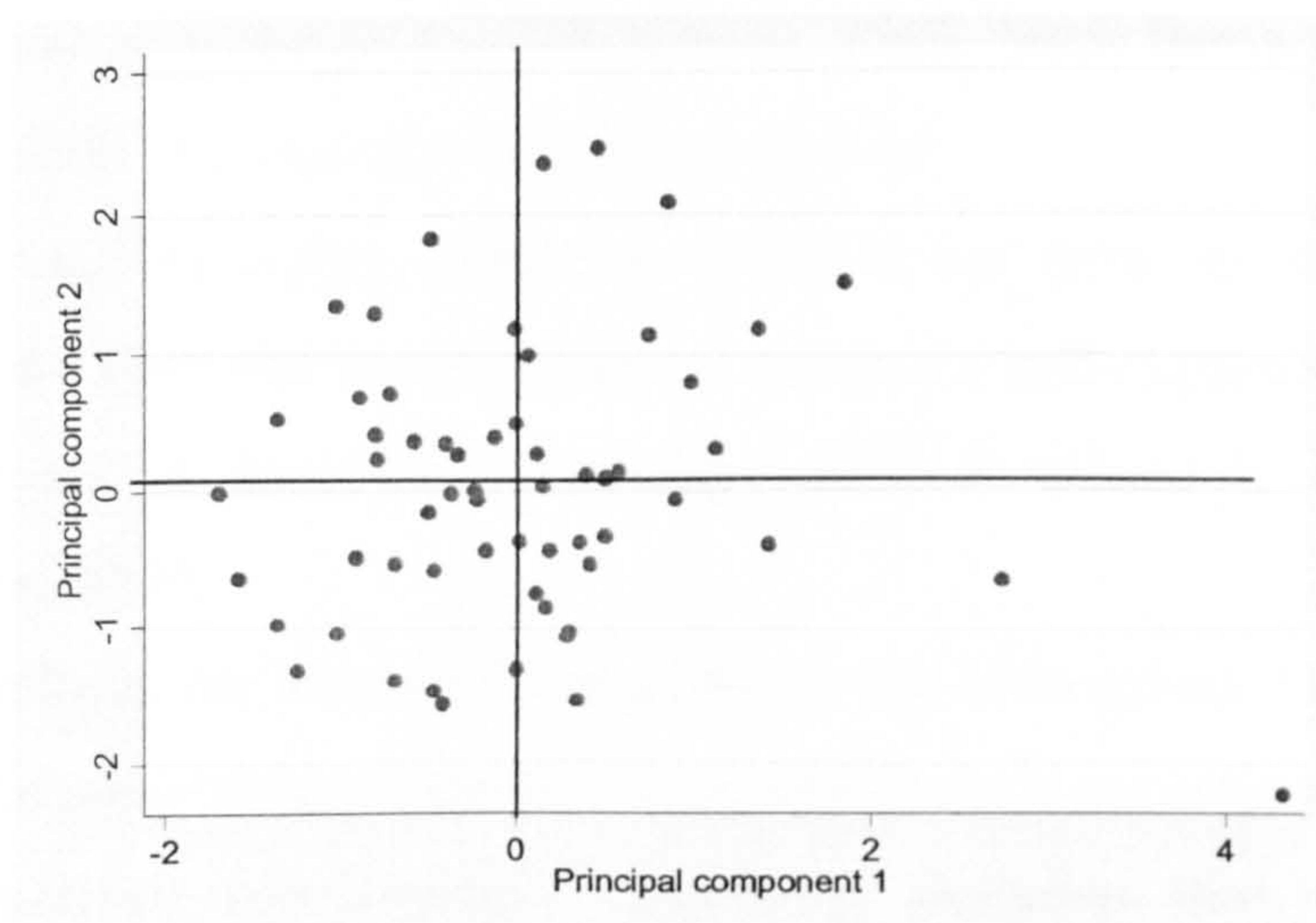
c) Distribution of the HHEH principal components

The scatter plot representing the distribution of scores for the two components of domestic hygiene obtained in the analysis (Figure 9-2) confirms that, as expected, there is no correlation between the two orthogonal components.

Two households showed outlying scorings: one had extremely low scores on *Order in the yard* and very high on *Avoiding dirt*, and the other had the second highest score on *Avoiding dirt* and a low, but within range, score on *Order in the yard*. In the house with extremely high scores on the *Avoiding dirt* scores and low on *Order in the yard* the index child's father (the HoH) had 6 years education and a clerical job. The mother was a farmer with 2 years education. The latrine had a cement floor with a lid in place and no visible faecal material. On the two potential faecal contact events the mother washed her hands with soap after disposing of the children's stools and a male adult who was seen entering the latrine washed his hands afterwards. Children's faeces were taken to the latrine. These events accounted for a high score on PC1. The structured observation notes revealed that this house had pigs and other animals that were not penned, which might have accounted for the low level of cleanliness of the yard. In the second house the HoH was a paid farmer with 3 years education, whereas the caretaker was a vendor of fabrics with 2 years of education. In relation to this house, no outstanding features were noted with regard to the state of the yard. On two occasions where defecation was observed, faeces were buried and taken to the latrine respectively and hands

were washed with water only. Like in the other household, the latrine floor and slab were cemented with a lid in place, which might have accounted for a high score regarding the state of the latrine.

Figure 9-2: Two way scatter plot of household scores on “order in the yard” (PC2) against “avoiding contamination” (PC1).



9.4 Discussion

Within the scope of studying patterns of HHEH practices, this chapter set out to explore the possibility that household environmental health aspects co-vary in important ways.

The results are indicative that hygiene and sanitation behaviours might occur not singularly but in coherent patterns. Two HHEH components were revealed by this analysis. The finding of the first grouping of practices suggests that households with tendencies of repeatedly disposing of children’s faeces safely also had the tendency to safely store water, wash hands after faecal contaminative events, and maintain the latrine unsoiled with the drop hole covered. These results cannot infer the underlying grounds for the clustering of these behaviours from the householders’ perspective. Notwithstanding this constraint, what is interesting is that from the public health perspective they incidentally relate to avoidance of contamination. This cluster of behaviours,

denominated *Avoiding dirt*, can contribute to avoidance of contamination of fluids (by protecting water containers), fingers, foods and the environment (by washing hands after faecal contact, clearing the latrine floor and yard of faeces, and covering the latrine pit and hence avoiding flies). What people in this study seemed to be avoiding through these behaviours is in common with items which have been regarded as unhygienic, dirty, and unhealthy in a study with mothers of small children in the UK (Curtis, 1998). Such items were: rubbish, faeces, germs, flies, blood, and contaminated water.

The second grouping indicates *Order in the yard*, as its structure is simpler than the first and its components are more self-explanatory. This is a particular symbol of good housekeeping which is valued in many African settings (Curtis, 1998).

By definition, the principal components are orthogonal. The fact that no correlation was seen between the two components is a consequence of the fact that PCA identifies components comprising elements that vary together independent of other possible components in the solution. Therefore we can more confidently suggest that 2 distinct levels of HHEH consciousness were identified.

Two variables did not take part in the final solution. Regarding the "mosquito avoidance" variable, the explanation is likely to be that the variable was expressed in a scale which did not correspond to that of the remaining variables. Moreover, unlike the other variables, these data were self-reported, not observed. Better measurements of other HHEH aspects, such as mosquito avoidance patterns, are needed to consolidate this type of approach. The other variable, "human faeces not seen in the yard" loaded highly on both principal components. According to the heuristics for PCA procedures and interpretation, double-loaders are advised to be removed from the solution to avoid ambiguities (Ferguson & Cox, 1993). Nonetheless, the fact that this variable loaded on both PC1 and PC2 continues to support the idea of clustering in the context of the set of variables included in this analysis, because if households are more likely to consistently remove human faeces from the

yard, it means that they tend to conform with both levels of hygiene consciousness identified in the analysis, namely *Avoiding dirt* and *Order in the yard*. Adding this variable back into the model did not destabilise the solution.

This grouping of household environmental health practices was not only meaningful for the purpose of interpretation of tendencies in people's hygiene and sanitation practices, but also to reiterate the importance of looking at environmental health behaviours holistically, since multiple unhealthy behaviours have been suggested to have synergistic effects on disease risk. As raised by Milroy (2001), since the variables related to sanitary conditions are highly correlated, and therefore the apparent magnitude of effect of one single variable is likely to reflect the collective magnitude of effect of that variable and other correlates, there is still a need to come up with valid methodologies for assessing impacts of sanitation interventions. Those authors, however concentrated their argument on service provision, where it is evident that geographical position and neighbourhood membership play a role in the observed clustering, whereas this study has looked at practices, the adherence to which is assumed to be within the control of each household. This finding suggests potential confounders for the effect of single hygiene or sanitation behaviours on diarrhoea in the homes.

It was found through this investigation however, that the way in which behaviours may cluster does not necessarily follow the structure of the main conceptualised domains shown in Chapter 1 (Table 1-2), and therefore formulations and internalisation of hygiene behaviour messages might not necessarily follow that conceptual pattern. The important relationship that leads to this is that found between overall frequency of hand-washing after critical events and frequency of safe disposal of faecal contamination in the homes, which is along similar grounds as the finding that choice of water source and sanitation behaviours correlate (Curtis *et al.*, 1995; Strina *et al.*, 2003), or that type of sanitation technology and hand-washing behaviours correlate (Hoque & Islam, 1995).

The important finding from this analysis is that there is the strong possibility that HHEH practices do cluster. However, both principal components were accountable for 41% of the total variance that the variables share. Therefore, the conceptualisation generated by this analysis can only illuminate on part of the picture of how, and, in the long run, why HHEH behaviours cluster together. Further, the fact that "Mosquito avoidance" did not take part in the model is a reminder that there is the possibility that the clustering of the variables partly reflects the way in which the data was collected. Therefore the mere fact that one variable was not collected in the same way as the remaining ones was sufficient to have the variable out of the model. Therefore it is important to acknowledge that this clustering and the way it was interpreted might be important from the observer's perspective but not necessarily from that of the observed, because it was the observer who decided on how to divide the observed world into measurable components. In this way, there is a need for further, in-depth inquiry into what these clustering of behaviours might mean from the householders' perspective.

Studies of this nature, but with larger sample sizes will allow the investigation of predictors for households to fall in the distinct categories of the clustered practices.

Since researchers are increasingly choosing to use indexes of HHEH practices to rate households according to their behaviour conduct (e.g., Armar-Klemesu *et al.*, 2000; Barrett & Browne, 1996; Gorter *et al.*, 1998; Strina *et al.*, 2003), this finding adds to the refinement of scales for domestic hygiene and sanitation practice. It also contributes to the improvement of hygiene promotion approaches (Westaway & Viljoen, 2000), if these approaches aim to simultaneously target multiple behaviours. Therefore findings from studies like this can help decrease the risk of combining fragmented and uncoordinated elements of behaviour change.

Implications for hygiene promotion emerge from these findings. First, it offers a systematic way of identifying positive deviants of overall hygiene practices, which is useful for evaluations that tend to measure large numbers of

hygiene practices. These deviant households can be used as role models for the rest of the target population. In the same way negative deviants can be identified and targeted, for example by applying more intensive techniques for behaviour change in comparison to the rest of the target population.

Second, clustering of behaviours can imply two opposing issues: (i) it may be harder to change one behaviour without targeting others at the same time, giving support to the thesis of holistic approaches to behaviour changes, such as community health clubs (Waterkyn & Cairncross, 2005), or (ii) there might be only the need to target a minimal number of hygiene practices without having to saturate people with multiple messages, and the rest of the practices will follow, though the mechanisms underlying this synchronization of practices is yet to be understood.

Chapter 10 Lay perceptions of Household Environmental Health

Chapter summary

This chapter has 6 sections. The first section (Introduction) synthesises what is generally found in the literature in terms of lay perceptions of hygiene, sanitation and mosquito deterrence practices, leading the argument towards the specific objectives addressed by this chapter. The Methods section gives an overview of the data collection process (which is more detailed in Chapter 4). This section also gives an account of the study participants. The Results section presents 5 topics in turn namely sanitation, hand hygiene, domestic hygiene, mosquito deterrence practices, and lay perceptions of disease causation and prevention (malaria and diarrhoea- like health problems). The results are then discussed in light of existing literature as well as the quantitative results of the present study. Conclusions with some implications are given in the final section.

10.1 Introduction

Previous chapters used quantitative data to investigate the relationships between HHEH practices and social and economic variables and concluded that part of those variables had an influential role in explaining patterns of above practices. However, the proximal determinants of behaviour are the cognitions of individuals. As a precondition for attempts to influence those behaviours, it

is crucial to understand the motivations for performing them, from the perspective of those engaged in the practices (Boot & Cairncross, 1993).

In most models explaining household-level health producing behaviours (either preventive or curative), knowledge of disease, beliefs and cultural norms have been important features (e.g., Berman et al., 1994). However, as such practices might not always be pursued with health in mind, public health scientists with a disease prevention perspective have sometimes failed to understand preventive practices. On the front of studying treatment seeking behaviour the picture has been slightly different because often such behaviour is triggered by the illness in question, therefore the investigation starting point is the disease or illness episode(s).

In the arena of mosquito control, many studies have addressed perceptions of malaria transmission mechanisms and reasons for not acquiring or using bednets. Financial constraint has been one of the leading impediments to bednet possession (Aikins *et al.*, 1993; Okrah *et al.*, 2002; The Netmark Project, 2001). Studies in many SSA settings have established that mosquitoes are part of the perceived aetiology of malaria (e.g., Aikins *et al.*, 1994; Alaii *et al.*, 2003a; Hausmann Muela, 2000; Lukwa *et al.*, 1999; Minja *et al.*, 2001; Samuelsen *et al.*, 2004; Vundule & Mharakurwa, 1996; Ziba *et al.*, 1994), but often mixed with other natural causes. Such causes include ingestion of certain foods (Aikins *et al.*, 1994; Okrah *et al.*, 2002; Samuelsen *et al.*, 2004; Vundule & Mharakurwa, 1996), contact with dirty or stagnant water (Minja *et al.*, 2001; Vundule & Mharakurwa, 1996), and bad hygiene conditions (Agyepong, 1992; Aikins *et al.*, 1994; Okrah *et al.*, 2002). On very few instances has malaria been related to supernatural causes such as deity (Aikins *et al.*, 1994) and witchcraft (Hausmann Muela, 2000).

Recent social marketing approaches to bednet promotion involved research on willingness to pay and factors that might influence acquisition of bednets. Reasons to use bednets have included reduction of nuisance (Agyepong & Manderson, 1999; Okrah *et al.*, 2002; The Netmark Project, 2001), privacy, warmth, protection from falling debris and other insects (Okrah *et al.*,

2002), and malaria avoidance (The Netmark Project, 2001). Scarce information exists on reasons why people continue to use the current methods of choice for mosquito avoidance, including the traditional techniques and if these techniques share the same motivations as those for bednet use.

In comparison, more advances have been made on the front of hygiene and sanitation. Social scientists in this area, borrowing from marketing research techniques, have moved towards getting information by keeping the focus on the product or the behaviour under consideration rather than the disease likely to be controlled. They also address attitudes towards current, less protective, practices and current risks, in order to bring to surface locally recognized negativities and good points carried by those practices, with the final goal of maximizing the appeal of the new practices.

Sanitation was driven by convenience and privacy (Jenkins & Curtis, 2005), and aesthetics and comfort were behind reasons for hand-washing (Fukumoto *et al.*, 1989; Kaltenthaler & Drasar, 1996b). Mother's nurturing tendencies were also suggested to drive the need for hand-washing before handling babies (Scott *et al.*, 2003). Common motivators for hand hygiene and latrine adoption included prestige, acceptance within society, and modernity (e.g., Curtis *et al.*, 2003; Fukumoto *et al.*, 1989; Jenkins & Curtis, 2005; Kaltenthaler & Drasar, 1996b; Rauyajin *et al.*, 1994; Scott *et al.*, 2003).

Regarding knowledge of diarrhoea aetiology, hygiene and faecal oral transmission mechanisms have been identified (Halvorson, 2004; Kaltenthaler & Drasar, 1996b; Rauyajin *et al.*, 1994; Westaway & Viljoen, 2000), but authors mention faecal oral transmission knowledge as among the least resounding. However constructs related to contamination and pollution are recurrent in the literature. Included in these is the spread of germs and dirt (Halvorson, 2004; Kaltenthaler & Drasar, 1996b; Pitts *et al.*, 1996; Westaway & Viljoen, 2000), either through contact with the human body or through insects and domestic animals (Jurg *et al.*, 1992; Westaway & Viljoen, 2000). The lay contamination constructs are only partially parallel to the biomedical microbiological concepts, because they are often explained in conjunction with the transgression of taboos. For

example, in provinces of Central Mozambique a certain type of diarrhoea was attributed to contamination of breast milk due to a new pregnancy or father's sexual intercourse outside the marriage (Jurg *et al.*, 1992). Numerous other perceived causes of diarrhoeal diseases have been documented, including sunken fontanel (Pitts *et al.*, 1996), bewitching, teething, food (Rauyajin *et al.*, 1994), weather (Halvorson, 2004), and deity.

In the light of this body of knowledge concerning lay perspectives of diarrhoeal disease and malaria, people's accounts of EH practices relevant to those diseases are the subject matter of this chapter, to identify enablers and constraints facing the performance of those practices behaviours in this particular setting. While recognising that generating an in-depth understanding of the perceptions of many different actors would be a task beyond the scope of this thesis, this chapter is an initial exploration.

10.2 Objectives addressed by this chapter

- To explore the extent to which biomedical environmental health practices are perceived as risky or protective to health, with particular focus on malaria, diarrhoea or related illnesses.
- To describe lay perspectives of causes attributed to diarrhoeal diseases and malaria or related illnesses.
- To investigate the extent to which currently used and desired (by householders) HHEH products relate to production of health and the extent to which they hold other social connotations in this setting.
- To understand the driving mechanisms and barriers influencing the acquisition and use of latrines and bednets.
- To investigate the extent to which the HHEH related constructs revealed in this chapter can be tied in with the behaviour predicting factors in the previous chapters.

10.3 Methods

The research reported in this chapter relied entirely on qualitative methods. Focus group discussions (FGD) and semi-structured interviews were employed in this investigation. While a brief account of the data collection process is given in the subsections below, the procedures followed, including details on the contents of the topics covered and sampling strategies used are presented in Chapter 4 (sections 4.4 and 4.6.1).

10.3.1 Focus group discussions

Twelve FGDs with residents of 3 neighbourhoods were conducted. Participants were separated according to age group and sex, giving 3 types of groups: young mothers, old women (grandmothers), and men (fathers), as can be seen from Table 10-1.

The FGD guides can be found in Appendixes 11 and 12. The discussions were focused on attitudes towards selected environmental health products and practices. Disease causation and prevention, with further emphasis on malaria-like ailments and diarrhoeal diseases were also topics of the discussions. The discussions were stimulated by visual aids and were facilitated by the principal investigator, who had already good experience in FGD facilitation, and one of the field assistants who was trained by the PI for this purpose.

Table 10-1: FGD participants and topics

FGD number	Neighbourhood	Participants	Topics discussed*
2	Ilha Josina	11 grandmothers	2
1	Ilha Josina	8-15 [‡] grandmothers	2
3	Ilha Josina	10 mothers	2
4	Ilha Josina	7-15 [‡] mothers	1
5	Ilha Josina	18-24 [‡] Fathers	1, 2
6	Mitilene	8 grandmothers	1,2
7	Mitilene	10 mothers	2
8	Mitilene	7 Fathers	2
9	Palmeiras	5-7 [‡] grandmothers	1
10	Palmeiras	7 mothers	1, 2
11	Palmeiras	14-12 [‡] Fathers	1
12	Palmeiras	6 Fathers	1, 2

*Topics: 1= Good and bad HHEH practices; 2= Disease causation and prevention

[‡] Number of participants in the beginning and at the end of the discussion

The number of topics discussed varied according to the pace and disposition of the participants and facilitator. There is no indication that this varied systematically according to types of respondents in such way to influence the conclusions, as the 3 types of respondents were in the end engaged in approximately the same type and number of exercises Table 10-2.

Table 10-2: Number of FGD exercises completed by type of group

Type of group	Number of exercises completed	
	<i>Nurse Felicidade</i>	<i>3-pile sorting</i>
<i>Grandmothers</i>	3	2
<i>Mothers</i>	3	2
<i>Fathers</i>	3	3

10.3.2 Semi-structured interviews

Twenty-five households were selected to be involved in semi-structured interviews. The selection procedure is given in Chapter 4 (section 4.6.1). The respondents were principal caretakers of small children (mothers and grandmothers). A summary of the demographic characteristics of the

households participating in this part of the study is presented in tables 10-3 through 10-5.

The interview guide, which consisted of open-ended questions, is presented in Appendix 10. Questions were designed to capture perceptions of HHEH from the angle of the use of products and technologies such as soap, latrines, bednets, or their alternatives. It further explored motivations, aspirations, and connotations regarding possession or use of the technologies in question, as well as preferences for technologies, and levels of satisfaction with currently used technologies and products.

Table 10-3: Characteristics of households involved in the interviews

Demographic characteristic	Parameters and measure
Neighbourhood	Freq. (%)
Ilha Josina	8 (35)
Palmeiras	8 (35)
Mitilene	7 (30)
Number of householders	Median (range) 5 (3- 15)
Number of children under 5	Median (range) 2 (1- 3)
Head of household sex	Freq (%)
Male	13 (57)

Table 10-4: Characteristics of the interview respondents

Respondents characteristic	Parameters and measure
Respondent's ethnic group	Freq (%)
Changana	19 (83)
Ronga	4 (17)
Respondent's age in years	Median (range)
	34 (17-58)
Respondent's relationship with index child	Freq (%)
Mother	18 (78)
Grandmother	5 (22)
Respondent's marital status	Freq (%)
Married/partner (cohabiting)	13 (57)
Married/partner (not cohabiting)	2 (9)
Divorced/separated	4 (17)
Widow	4 (17)
Respondent's education	Freq (%)
None	12 (52)
Adult literacy	2 (9)
Lower primary	7 (30)
Upper primary/secondary	2 (9)
Respondent's occupation	Freq (%)
Unemployed/housewife	4 (17)
Subsistent farmer	9 (39)
Agriculture labourer	2 (9)
Vendor	6 (26)
Other (maid, bartender)	2 (9)
Respondent's income	Freq (%)
None	11 (48)
Irregular	9 (39)
Regular	3 (13)

Table 10-5: Environmental characteristics of households involved in the interviews

HH environmental characteristics	Frequency (%)
Housing type (walls)	
Cement or zinc	2 (9)
Reeds daubed with mud or cement	14 (61)
Bare reeds	7 (30)
Latrine ownership	
Yes	19 (83)
Soap ownership	
Yes	14 (61)
Mosquito avoidance products currently used**	
None	2 (9)
Bednet	7 (30)
Coil	4 (18)
<i>Sule</i>	13 (57)

** There were households using more than one product

10.3.3 Data management and analysis

Semi-structured interview and FGD data were recorded in the form of annotations, whilst the sessions were conducted. The notes were typed in using MS Word and imported to the data analysis software.

Analysis was carried out using NVivo 2.0 (QSR International Pty. Ltd. 1999-2002), a computer aided qualitative data analysis software. This software facilitates, in a systematic way, the otherwise manual process of cutting, pasting and organising labelled sections of text (Gibbs, 2002), in order to assist the investigator to reflect on the data en route for higher levels of conceptualisation.

The exploratory nature of this study meant that no concrete hypotheses had been defined at the outset of the analysis, therefore it was appropriate to use NVivo, since it supports grounded approaches to analysis (Gibbs, 2002). Notwithstanding the inductive approach, it is not claimed here that pure grounded theory is used because the way in which information was retrieved led to considerable filtration of the data. For example while in some cases

interviews and FGDs were conducted in local vernacular, they were annotated in Portuguese. Further, the annotation approach did not allow generation of data as rich as would have been possible should tape-recording and *in verbatim* transcriptions have been carried out.

The approach used for analysis followed that suggested by Gibbs (2002). Primarily, open coding was performed, whereby broad concepts in the text were revealed whilst reading it and sections of text were categorised according to common general themes. These categories or labels started off as free nodes in this primary stage of coding. With further reading of the texts, additional occurrences of the categories were identified and labelled accordingly. Secondly, axial coding took place whereby, after similarly coded text was retrieved, nodes began to branch out (node trees) and connections between them were gradually established (Gibbs 2002). The structure of the node trees kept being rearranged throughout the analysis process. Some nodes remained unconnected (free nodes) after this process was finalised.

When relationships between two or more nodes began to surface, the questioning and comparison method was employed (Gibbs, 2002). This was done by running systematic searches for passages containing likely key words representative of the suggested relationships, in order to verify if such relationships were recurrent throughout the interviews and FGD texts.

Throughout the analysis process it was always possible to jump back to the original text from which the data originated. In this way, and as argued by Gibbs (2002) in response to some sceptics towards the use of computerised qualitative data analysis approaches, the researcher was never distant from the data. This was particularly useful to retrieve illustrative quotes.

10.4 Results

Data was originated from the contents of all FGDs and of 23 interviews. Two interviews, both in Mitilene, were interrupted therefore discarded.³⁴

Initially, 5 categories of aspects with a potential link to environmental health were identified from the open coding, namely:

- Technologies (e.g., soap, latrines, bednets, mosquito coils)
- Practices (e.g., hand-washing, soap use for personal hygiene, open defecation, latrine use, mosquito avoidance)
- Nuisances in the environment that people tended to avoid
- Common diseases and their causes

In this section, firstly topics are teased out and discussed separately according to the HHEH themes that run throughout this thesis. Secondly, the subjects are discussed from the angle of disease causation. Finally the elements are drawn together, according to the configuration found in the coding process to make a picture of the way HHEH practices are viewed from the perspective of the study participants.

10.4.1 Sanitation

a) Perception of stools

In general, both from FGDs and interviews, it emerged that stools, especially when sited in the open, had the following negative characteristics:

- Are smelly
- Attract flies
- Cause disease

³⁴ These interviews were not successful because, in the first case, the respondent found the questions too delicate and rather personal, therefore choosing to interrupt the interview. In the second case, the interviewer was verbally intimidated by suspicious neighbours, who mistook her for a political party activist, therefore she chose to end the interview.

- Attract animals
- Pollute food
- Are dirty
- Contain microbes, or little bugs (*xipunguana*)

Among the harmful and inconvenient facets of human stools, smell was mentioned in most interviews, followed by disturbance of aesthetics, attraction of flies and disease causing. Of the women who mentioned disease causation in this perspective, few gave more detailed explanations for the mechanisms of such causation. To those who gave details, flies and animals, and not the faeces themselves were at the centre of the disease causation mechanism. In this perspective, the smell attracted flies to the home environment, and these flies, which as such were already carriers of disease (or little bugs, as put by one respondent), were more likely to land on food or utensils in turn causing disease. Animals, in particular chickens, ducks, and pigs, played a similar role to that of flies. One respondent's account to the process of disease transmission differed in that she mentioned direct faeces ingestion by children in the homes as a risk to disease.

Only a minority of the interviewed considered adults' stools to be worse than children's, and that was because adults' stools were smellier. Despite the fact that both types of stools were considered by most as similarly bad, the sight of adults' stools, compared to children's, was considered much worse because the former were associated with the shameful behaviour of practicing defecation on unscreened sites, which created a bad appearance and impression, and disturbed the aesthetics of the living environment. The sight of children's stools was more acceptable because it was not a shock nor shameful to think of, or even to observe children performing open defecation.

b) Latrine possession

Wealth, which emerged from the quantitative analysis as not being a key predictor of latrine possession (Chapter 7), was a much debated component in

the discourse regarding latrine acquisition. Most interviewed mothers with latrines pinpointed poverty as an impediment for others to build a latrine. Concordantly, to the eyes of the people representing households without latrines, lack of financial resources was seen as the main constraint. The only characteristic in common among these households with no latrine was that none of the caretakers had any formal schooling. On the other hand FGDs ran in disagreement with the position that wealth was important, on the grounds that latrine materials were costless.

A degree of stigma towards people without latrines was sensed from the data, but this stigma was more associated with social disapproval than with physical aversion to possible consequences of open defecation (e.g., faecal contamination, pollution, or disease). In fact it emerged that people without latrines could still be considered clean to a certain extent (e.g., see last illustrative quote on bottom row of Table 10-6). *Futa*³⁵ was a strong component in the part of the discussion on barriers to having a latrine, especially coming from criticisms, by men, on certain women's attitudes.

People considered heads of household as having failed to reach *a state of completeness* if their houses had no latrine, meaning that latrine acquisition contributes to one's sense of achievement. On further exploring this subject of *completeness*, there were other aspects that emerged as representative of an incomplete home, namely: a HoH without a wife, a marriage without children, and a housewife without a kitchen. A household without a man in charge was not considered to be as incomplete as a household where the HoH was wifeless.

Exceptions where people were "allowed" not to have acquired latrines did not include the direct markers of poverty and wealth, as defined in Chapter 6. Lack of self-reliance (e.g., due to disability, or lack of an able male householder) was the most acceptable constraint towards building of latrines, as can be seen from Table 10-6.

³⁵ *Futa* - Changana term designating neglect, messiness, disorder, and clumsiness. In Siteo, B. (1996). *Dicionário Changana-Português*. Maputo: INDE.

Table 10-6: Perceived characteristics associated with not having built a latrine in the compound.

Attributes associated with latrine possession status	Illustrative quotes
Respect/ Authority	<i>"...anybody that passes by and feels like defecating on the path or misbehaving will have no fear of doing so, and the owners [of the house with no latrine] will not have the right to complain nor to stop the passer-by from doing so" (Man, FGD)</i>
Completeness	<i>"These families are not complete" (Man, FGD)</i>
Health	<i>"People defecate everywhere and it is therefore easy to catch disease because flies stick to faeces and then land on food..." (Man, FGD)</i> <i>"... because even if they bury them [faeces], chickens can unearth them and create dirt all over, they can also take the dirt to the food and bring disease" (Mother, int. vendor, 6 yrs sch.)</i> <i>"...we can all catch disease because of them, because flies can land on faeces and then touch us..." (Woman, FGD)</i>
Social commitment	<i>"...they are not good people, they jeopardise the rest " (Woman, FGD)</i> <i>"Even if the majority of us have latrines, the one family without a latrine will make the whole neighbourhood have a bad reputation" (Man, FGD)</i>
Futa	<i>"They have futa and have no culture, they are very messy people" (Int. mother, housewife, 2 yrs sch.)</i> <i>"...the culprit is the wife, who is neglectful.." (Woman, FGD)</i> <i>"Those people are messy" (Man, FGD)</i>
Value for self	<i>"People with no latrines? They don't like their own bodies" (Int. mother, agric. labourer, no sch.)</i>
Awareness	<i>"It is not that they haven't heard about latrines: everybody knows that latrines exist..." (Man, FGD)</i>

Table 10-6 (continued)

Attributes associated with latrine possession status	Illustrative quotes
Interest/ Initiative/ determinism	<p><i>"It is the husband who has no time to think about building one because he is always drinking" (Woman, FGD)</i></p> <p><i>"Those people that have no latrine, because they have no interest..." (Int. mother, agric. labourer, 3 yrs sch.)</i></p> <p><i>"the woman should push him [to build a latrine]." (Woman, FGD)</i></p> <p><i>"A person only needs to be dedicated to have a latrine, you can cut reeds and wood from the bush..." (Man, FGD)</i></p>
Traditionalism/ habit	<p><i>"The people that live in the bush usually don't have latrines...it is simply because they are from the bush" (Woman, FGD)</i></p> <p><i>"...but yes, due to habit and tradition from these families that are unable to build a latrine" (Man, FGD)</i></p> <p><i>"Some people follow old habits.." (Int. mother, housewife, 5 yrs sch.)</i></p>
Wealth	<p><i>"...you don't need to have money to build a latrine" (Int. mother, agric. labourer, 3 yrs sch.)</i></p> <p><i>"...the majority of the materials for a latrine, those with only a hole, are not purchased." (Int. grandmother, housewife, no sch.)</i></p> <p><i>"...on the other hand there is sometimes lack of materials to build a latrine" (Int. Mother, housewife, 5 yrs sch.)</i></p> <p><i>"it is not about lack of materials because here in order to have a latrine one does not need money." (Man, FGD)</i></p> <p><i>"It is people with no money" (Int. Mother, housewife, no sch.)</i></p>
Self reliance	<p><i>"...others [who do not have latrine] it is because they have no-one to help. For example that blind woman [the neighbour], she is very clean, but has to live without a latrine because she is unable to build one." (Mother, int. domestic, no sch.)</i></p> <p><i>"They are probably women without husbands, they live alone...also old people usually do not have latrines" (Int. Mother, vendor 6 yrs sch.)</i></p> <p><i>"They [those with a latrine] are people that have men around to help them" (Int. grandmother, housewife, no sch.)</i></p> <p><i>"Because I still haven't managed to call someone to come and help me, and there is no one living here [in this house] that is capable of building a latrine." (Int. grandmother, housewife, no sch.)</i></p>

c) Technology Preferences

Although latrines were commonplace in this study area, caretakers expressed dissatisfaction with the current designs, showing more preference for latrines with a lined pit and a cement slab, generally referred to as *latrinas melhoradas* (improved latrines). The principal marker of the *latrinas melhoradas* is the dome shaped slab, which appears to be quite admired but not widely owned by households.

"The round slabs are more beautiful." Interviewed mother, vendor 6 yrs schooling

Despite the fact that improved latrines were viewed as expensive to build, over half of the interviewed women were already at the stage of considering, or had considered at some point in the past, upgrading their latrines. In many of the cases, there was the perception that the initiative to upgrade the latrine was dependent on women.

The key appeal of this type of latrine was that they came with a lid, which would help contain the dirt and the smell and in turn the concentration of flies in the homes would decrease. In addition, improved latrines were perceived as long lasting, especially regarding resistance to rainwater, which was also connected with improved safety. Finally the cement slabs were viewed as comfortable for they were easy to squat or sit on. Some mentioned this advantage in connection with children's safety.

"*Latrinas melhoradas* are good for children. For the adults they are also good, because those *m'benga* ones [ceramic bowl seat] heat up and it is not easy to seat on them. With the round ones there is no need to seat, they are comfortable as they are for squatting." Woman, FGD

There were also interviewees who saw no advantage of an upgraded latrine.

"There is no difference between the latrine I have and the *latrina melhorada*. They all serve the same purpose." Interviewed grandmother, vendor, no schooling

The sense of household and individual accomplishment identified as a driver for latrine acquisition re-emerged in the process of longing to upgrading a latrine, as expressed in the following passage of an interview:

Q: "What do you think of families that have that type of latrine [the one with the dome-shaped slab]?"

A: "Those families are even more complete than us, whom only have the traditional latrine." Interviewed grandmother, vendor, no schooling

d) Sanitation arrangements for children

It was commonly assented that small children were discouraged from defecating in the latrines, and the debut age for latrine use by children was clustered around the age of 3 years.

Children were not encouraged to use latrines because of the danger of falling in the pit.

On discussing mitigation to this problem, mixed views surfaced from respondents' discourses. Some believed that stricter training would be a solution. Further solutions included assisting the child every time they used the toilet until they learnt how to use it, incorporating a dome-shaped cement slab to reduce the risks of children falling, and one mother recommended potty use. There were still a number of mothers who had not thought of ways to overcome this situation.

"Nothing can be done. I am not interested in thinking of ways of making her use the latrine. It does not make sense to think about it because I do not want her to fall into the pit." Interviewed mother, farmer, no schooling

10.4.2 Hand hygiene

a) Hand-washing practice

Hand-washing was reported as a key practice to be carried out on the following junctures³⁶: before eating and after eating, after using the latrine, before preparing food and after cultivation. According to most FGD, before eating and after latrine use were the most important moments when they felt that hands should be washed. Hand-washing after latrine use was perceived as more important if food handling followed.

“Particularly those that prepare food must wash their hands always after going to the latrine” Grandmother, FGD

Particular moments in the preparation of certain foods seemed to be very important, for example right before washing rice that was about to be boiled, and before grinding maize.

A few responses pointed to the importance of washing hands first thing in the morning, because, as put by one woman,

*“...even if my hands do not feel dirty, I am going to use them to wash my face and body, as well as my children’s, and I will have to prepare food in the morning... I cannot soil these things with the dirt from the bed”
Woman, FGD*

Diarrhoeal disease prevention was almost not considered a reason for hand-washing. Only one woman said that diarrhoea was caused by lack of hand-washing after latrine use. However, in all FGDs with mothers and some with men, hand-washing was talked about as a preventive measure against cholera.

³⁶ These junctures were self-reported. However, after the respondent had stopped listing all the junctures they seemed to have in mind, prompts of the nature “any other moment?” were given in order to facilitate the recalling process.

b) Cleansing agents

About 1/3 of the women interviewed did not have soap in the house, and were not aware of any substitutes for soap. Consistently, both from FGDs and interviews, soap purchase responsibility was attributed to women.

While water was thought to be enough for the removal of dirt from the hands, for example after cultivating, and for hand-washing before eating or after latrine use, soap use was considered useful to remove smell and other discomforts, particularly from handling kerosene, oil, or fish.

Soap was also considered important for bathing children, especially from the view of old women and men. It was said to help blood circulation, avoid disease-causing smells (fever and *rumsana*, a type of diarrhoea). Skin cleansed with soap was said to breathe better.

In addition, lemon tree leaves and lemongrass were popular means of further "cleansing" the hands when they remained smelly after washing, especially following the handling of raw fish. One woman reported using lemongrass even after washing hands with soap.

"I use lemon leaves whilst drying my hands [after washing them] to kill unnecessary smells, like the smell of fish which is not pleasant at all."

Interviewed mother, agricultural labourer, no schooling

"Lemon grass leaves disinfect the hands after removing the scales of fish, or after touching something with a strange smell." **Woman, FGD**

10. 4. 3 Domestic hygiene

The 3 pile sorting exercises revealed domestic hygiene practices that were valued and those that were not appreciated by the participants.

Young women and men said that rubbish was a source of cholera, therefore it had to be swept away daily, especially during the mango season, to avoid flies and mosquitoes attracted by the smell emanated by the fruits.

"Sweeping the yard gets rid of the smells which cause disease". **Mother FGD**

Further, according to men, rubbish attracted ants, cockroaches and rats, which provoked stomach aches and diarrhoea. Men also said that rubbish and messiness were an important cause of fever and malaria, and that dust should be swept away to avoid coughs and diarrhoea.

Unlike young women, who only tended to focus their discussions on disease links with cleanliness, men associated cleanliness of the yard with both disease prevention and social approval as the following quotes show (all from FGDs with men):

“we will give her better value if the woman maintains the yard clean”

“a stranger will not hesitate ask for water to drink if they feel thirsty on the way home from the field”

“Those with clean yards also store their water in clean and covered jerrycans where mosquitoes cannot enter and deposit their disease”

“visitors will not refuse to be served food”

Older women on the other hand, were mostly concerned with the aesthetic and prestige values of domestic hygiene, as illustrated by the following passages of FGDs with grandmothers:

“Rubbish all over the place is ugly”

“It is pleasant to visit a fresh and clean house”

“An organised house gives a good appearance”

“She gets prestige and sets good examples to younger girls”

“No matter how clean she is and how clean the clothes may be, we will see her as a dirty person because of her unorganised house.”

These quotes show that cleanliness of the yard is a responsibility of women and the appearance of the yard is the outward expression of a woman's personhood.

10.4.4 Mosquito deterrence

a) Perception of mosquitoes

Mosquitoes were considered a great nuisance. The foremost mentioned nuisances were bites, especially during bedtime, which obstructed the sleep. During interviews, when asked about other problems caused by mosquitoes, often the term "disease" without further detail was mentioned. Blemishes in the body were the most talked about health problem caused by mosquito bites. Malaria was mentioned after some prompting. Other health problems were aches and pains and *heaviness of the body*, which is a state of malaise and weakness mostly felt in the morning after a bad nights sleep.

b) Bednet possession and use

Bednets were items that most interviewed women desired to acquire. Normally bednet acquisition would depend on the initiative of the head wife alone despite the fact that the money would have come from the HoH.

Two of the areas involved in this investigation had benefited from bednet distribution during the 2000 floods, hence an enclosure of a good proportion of bednet owners in this sample compared to the sample for the quantitative study presented in Chapter 8.

A summary of findings in relation to connotations that bednet possession carries is shown in Table 10-7. There was no indication of differences in opinions, between current bednet users and non-users, with regards to characteristics associated with bednet possession status.

From the interviewed bednet owners, it emerged that the majority had received them from NGO donations. Two women, both vendors with 3 and 6 years of education respectively, had bought them in Maputo, one out of her own initiative and the other out of her husband's.

Table 10-7: Perceived individual and household characteristics associated with status of bednet possession.

Attributes associated with bednet possession status	Illustrative quotes
Well-being	<i>"If you sleep in a bednet you wake up with good disposition to work..." (Int. grandmother, vendor, no sch.)</i>
Protection	<i>"They are well because they are protecting themselves from mosquito bites. They do not get disturbed by the noise that they make" (Int. grandmother, vendor, no sch.)</i>
Lack of interest/initiative	<i>"..it is also lack of interest that impedes them to even think about it" (Int. mother, housewife, 4 yrs sch.)</i>
Habit	<i>"we are not used to bednets" (Int. mother, farmer, no sch.)</i>
Lack of money	<p><i>"They are poor and did not have the luck of receiving one during the distributions" (Int. mother, agric. labourer, no sch.)</i></p> <p><i>"I think it is people that have money because they work, whereas here, neither me nor my husband has a job. We cannot have bednets" (Int. mother, vendor, no sch.)</i></p> <p><i>"The people that do not have [bednets] are people with minimal living conditions and nothing more" (Int. mother, vendor, 6 yrs sch.)</i></p> <p><i>"Many people prefer other methods to bednets because they [the other methods] are for free" (Woman, FGD)</i></p> <p><i>"[I do not have a bednet] because I don't have money" (Int. grandmother, housewife no sch.)</i></p>
Misfortune	<p><i>"...because when they distributed them, my name was not on the list to receive one" (Int. mother, farmer, no sch.)</i></p> <p><i>"They did not have luck during the distributions" (Interviewed mother, agric. labourer, 1yr sch.)</i></p>

Very few interviewees, all but one with no income nor formal education, did not know where bednets could be obtained. From the remaining interviewees and FGDs it was found that local markets and street vendors were the places that people were most aware of with regards to how bednets could be acquired, followed by shops both in Manhiça and Maputo.

There was less awareness about the price of bednets than there was of the places to purchase them. Of those that declared that they knew the price, both perceived and experienced, it was almost invariably 130,000MT to

150,000MT³⁷. At the time of the data collection period, informal queries revealed that bednet prices ranged from 140,000MT to 150,000MT in the main market in Manhiça.

FGD participants reported that generally HoH would be given priority for bednet use, although the majority of these participants did not actually own bednets.

“I would give priority to the father of my children. Anyway, he would not accept to watch my children and myself sleeping under a net, while he was suffering with mosquito bites...” **Woman, FGD**

However, of the households that had at least one bednet, in only one the bednet was reserved to the single adult male in the house. That bednet was currently not being used because the owner worked in South Africa most of the year and no-one else had permission to use it.

Amongst the non-owners, only 2 said that the *father of the house* would be prioritised because, being the main bread winner he had to feel well at all times (malaria was not particularly mentioned). The remaining interviewees would prefer to give the nets to their youngest children on the grounds that they were the most vulnerable to disease, or that they were unable to fan themselves rid of mosquitoes compared to adults and older siblings. Although no specific disease was mentioned, this shows that mosquitoes were recognised as disease threats to children.

There were no particular insights as to why certain children would be prioritised and others would not. Neglect towards certain children was captured, but not in relation to bednet allocation. During FGDs with men, on asking what other practices were not acceptable, they said that certain illegitimate children were provided with less food and less quality clothing compared to legitimate counterparts.

³⁷ £1 is was approximately 38,000MT at the time the field research was conducted

c) Use of mosquito coils

Very few of the interviewed households were using mosquito coils on a daily basis, at the cost of 1.000Mt to 3.000MT per day, and even fewer were employing them to complement the use of bednets. All of them were satisfied with the results of this technology. Users said that coils were cheap and the best alternative to bednets.

Of the above users, the mother was the person that had decided upon the use of such method and the money came from her own pocket. In only one household the idea to use the product came from the father but both the mother and the father contributed to the daily purchase of coils. Mosquito coils were amongst the most contemplated alternatives to people who were currently using *sule* or nothing.

"I would prefer the *dragão* [common name for mosquito coils] because it is a bit cheap, and because I have many children...I think the method is reasonable because all of us would be protected" Interviewed mother, farmer, 2 yrs schooling

d) Sule use

Sule is the vernacular name for the traditional fumigation. This simple technology consists of lighting up organic material on a piece of metal or clay, often an old saucepan or clay pot lid, overnight. Materials are moistened first, in order to avoid burning and maximize smouldering time.

"First we wet corn cobs and then arrange them on a little pile, sometimes with some candles and we set it on fire inside the room with the door shut. Just before we go to bed, it stops burning and starts smouldering. Then we open the door to let out excess smoke. And we go to bed. It is good because at least we can fall asleep without disturbances."
Interviewed mother, maid, no schooling

The range of materials used for *sule* did not differ much from that detailed in chapter 8. Cow and goats dung was exceptionally used in the area Ilha Josina.

Despite being widely used, people showed dissatisfaction towards *sule*. Below is a list of the disadvantages surfaced in this study:

- Leaves clothes and house smelling badly
- Only deters mosquitoes, does not kill them
- It does not make a big difference between using it or not in terms of preventing *body heaviness*³⁸
- Brings other health problems (especially coughs in children)
- Provokes house fires

Males were not involved at all in the decision to use *sule*. The decision to use this method came from mothers and grandmothers, who were involved in collecting the materials, along with children.

10.4.5 Perceptions of disease causation

a) Malaria

Malaria was viewed as a great threat to small children because it made them weak and was a dangerous killer. The term *malaria* was sometimes interchanged with *dzedzedze*. However, in the FGD held with older women (grandmothers) *dzedzedze* was unanimously held as separate from *malaria*, and, in such cases, no-one knew its causes as illustrated in the quote below:

"Malaria is caused by mosquitoes, and flies, which transmit little bugs from faeces to food...Dzedzedze? I don't know what causes it, it is different from malaria." Woman, FGD

It was felt that *malaria* was the closest to biomedical malaria. Although there were symptoms in common between *malaria* and *dzedzedze* (headaches, shivers, weakness, fever, and feeling cold) malaria was unique in causing vomiting and lack of appetite. Further malaria was said to be diagnosed through biomedical confirmation.

³⁸ Body heaviness is considered a mild illness characterised by general indisposition to work, tiredness and weakness, sometimes accompanied with headaches. It is thought to be directly related to hard work and a bad night's sleep.

"For many people suffering from *dzedzedze*, they [referring to medics] cannot find malaria in the blood." Man, FGD

Undoubtedly, mosquitoes were the chief perceived cause of malaria. However, there were other causes of the disease. Malaria was occasionally mentioned when discussing products and technologies to avoid mosquitoes, and mosquitoes were heavily referred to on discussing malaria causation. Only a minority of the interviewed women did not know what caused malaria.

The main elements involved in the transmission of malaria were vectors (mosquitoes/flies), contaminants (dirt/microbes/faeces), climatic conditions (stagnant rain water/weather/sun), food, and fate. Below is a scheme summarising how malaria causation was explained.

Table 10-8: Schematic representation of how people explained malaria causation in Manhica

Elements involved in malaria causation	Details of malaria causation mechanisms
	Fate
	Misfortune
	Illness dictated by God
	Climatic conditions
	Appears suddenly with change of seasons
	Excess exposure to the sun
	Stagnant water breeds mosquitoes
	Vectors
	Mosquito bites
	Mosquitoes transmit it from person to person
	Food
	Mosquitoes/flies transport dirt/microbes/faeces from the environment to people/food/drinking water
Contaminants	Direct contact of people with dirt/faeces from the environment
Negative hygiene behaviour	Lack of personal hygiene

b) Diarrhoeal disease

Diarrhoea in children was considered a problem, but not as threatening as malaria. As can be seen from Table 10-9, 11 types problems associated with diarrhoea were revealed through the FGDs.

Table 10-9: Diarrhoea-related illnesses

Type of diarrhoea	Symptoms
<i>Rumsana</i>	<ul style="list-style-type: none"> ▪ Weakness ▪ Yellow, very frequent and watery stools ▪ Stools smelling of rotten egg ▪ Vomiting ▪ Swollen abdomen ▪ Weight loss ▪ Lack of blood
<i>Kudjambeliwe</i>	<ul style="list-style-type: none"> ▪ Wrinkled skin ▪ Weakness (child cannot sit straight, leans forward) ▪ Weight loss ▪ Loose whitish stools
<i>Normal diarrhoea</i>	<ul style="list-style-type: none"> ▪ Loose, not too frequent stools ▪ Not water
<i>Bloody diarrhoea</i>	<ul style="list-style-type: none"> ▪ very frequent stools ▪ Blood in the stools
<i>Xilala</i>	<ul style="list-style-type: none"> ▪ Veins in the head swell and become visible ▪ Head enlarges and softens ▪ Sunken fontanel (divides head in the middle) ▪ Fontanel moves very fast ▪ Hair straightens ▪ Weight loss ▪ Some diarrhoea
<i>Teething diarrhoea</i>	<ul style="list-style-type: none"> ▪ Loose stools, not too watery ▪ Not too frequent
<i>Cholera</i>	<ul style="list-style-type: none"> ▪ vomiting ▪ Very frequent diarrhoea ▪ Extreme weakness
<i>Xirrheve</i>	<ul style="list-style-type: none"> ▪ Fever ▪ Lathery stools ▪ Hardened abdomen
<i>Dhlisso</i>	<ul style="list-style-type: none"> ▪ Stomach ache ▪ Loose stools (not always the case)
<i>Xicuna</i>	<ul style="list-style-type: none"> ▪ loose and frequent stools ▪ bruises in the anal region
<i>Wheti</i>	<ul style="list-style-type: none"> ▪ Some diarrhoea ▪ Vomiting ▪ Startling, fits, and fainting

Only one interviewed woman claimed not to know what caused diarrhoea. Amid the complex explanations for its causation, flies and food were dominant aspects, and quite often inter-related. Other causes of diarrhoea are given in Table 10-10.

Part of the complexity in diarrhoeal disease aetiology was due to the already mentioned diversity of diarrhoea types. *Normal diarrhoea* and cholera were those most often associated with hygiene and food. Rubbish clearance and yard sweeping was only mentioned in relation to cholera. An interesting relationship between cholera and rubbish was noted. In two discussions it emerged that while very clean people managed to avoid cholera, those with too much rubbish in the house did not get any cholera either.

"it is only those people that only clean the yard from time to time (*de vez em quando*), that always get sick in the season of cholera" **Man, FGD**

From other FGDs it was also clear that only certain people were vulnerable to cholera, but a different argument was held.

"Not all people catch cholera, only the weakest" **Mother, FGD**

"There are neighbourhoods that are very dirty, with much garbage scattered, but only some get cholera" **Grandmother, FGD**

The only one type of diarrhoea caused by witchcraft was *Dhliisso*, whereby poisonous matter suddenly appeared inside one's stomach. There were 3 types of health problems, namely *Xilala*, *Whêti* and *Rumisana*, which were thought to be congenital. In such cases the child was born with a special type of worm (*Nyokana* - literally "little snake"), which when disturbed triggered various symptoms including diarrhoea. These diarrhoeas could only be prevented through a traditional prophylactic treatment given to infants from moments after birth until the weaning stage, which protects the child from various dangers including illnesses and predator bites. This treatment is described in detail elsewhere (Junod, 1996; Munguambe, 2001).

Table 10-10: Schematic representation of how people explained diarrhoeal diseases causation in Manhiça

Elements involved in diarrhoea causation	Details	
Witchcraft	Poisonous matter inserted in person's stomach	
Transgression of taboos	Polluted breast milk by father's heat or sperm. Spoilt breast milk from new pregnancy If a person with a <i>hot body</i> ³⁹ holds a child	
Symptom/ outcome of underlying phenomena	<i>Wheti</i> (illness of the moon) <i>Xilala</i> Teething Fever	
Contaminants	Air	Breathing on air that contains the disease
		Accidentally touching faeces from the environment
	Vectors	Flies, naturally dirty, are attracted by animal and human (children's/adults') faeces/smell
		Flies picking up the faeces dirt Rubbish attracts cockroaches, rats, mosquitoes, and flies which scatter dirt throughout the house
		Foods soiled with faeces through flies
	Ingestion	Mosquitoes enter drinking water vessels and deposit dirt
		Dust into the food
		Children eating dirt Eating unwashed fruit
		Spoilt food Badly cooked food Poorly digested food Excessive consumption of mangoes
		Eating unripe mangoes Not chewing food properly
Drinking water from a different neighbourhood Drinking pond water		
Negative hygiene behaviour		Not washing hands after using the latrine/coming from the field
	Using leaves to clean child's bottom poisons the gut	
	Disliking bathing	

³⁹ A person is said to have a *hot body* if has very recently had sexual intercourse, is on her period or has just had an abortion. The state of having a *hot body* aggravates if the sexual encounter is with another person that has a *hot body* for the above reasons.

10.5 Discussion

This part of the research was oriented to investigate how people make sense of the environmental actions they take, the environment they live in, and the diseases of interest in this study.

Incorporation of biomedical models of disease causation with traditional explanations was visible. Both personalistic and naturalistic explanations of disease were held by the studied population. However, there was no clear line dividing the two, contrary to what is portrayed by this classification. While personalistic explanations of disease hold that illness, religion and magic are intercorrelated and disease is caused by the purposeful intervention of an agent (be it human or supernatural), naturalistic explanations hold that disease emerges from impersonal, mechanistic causes in nature or the body (Foster, 1976).

Regarding malaria causation, mosquitoes were heavily related to it, and most of the other causes were environmental. Deity explained malaria but not in the sense of people being victims of punishments by the supernatural, contrary to what was found in Ghana where malaria was attributed to the action of angry Gods (Agyepong, 1992). Instead God was representative of fate, in that there were phenomena that could not be explained and were bound to happen. One such phenomenon was malaria and/or *dzedzedze*. Witchcraft did not take part in the local constructs of malaria, differently from what was recorded from Tanzania (Hausmann Muela, 2000).

With regard to diarrhoeal disease, both biomedical and lay models served to explain its aetiology, but personalistic and supernatural causations were more visible compared to malaria aetiology. In common with malaria, environmental risks featured markedly in the disease causation explanation for diarrhoeal diseases, in particular cholera.

Adults' stools were viewed as more detrimental than children's because they carried social connotations, which made them less acceptable to observe. However in a different respect there was no difference between children's

stools and adults', because children's faeces were perceived to be as harmful as adults', unlike what has been reported elsewhere. In Botswana children's faeces were viewed as not dirty because the smell was not so strong (Kaltenthaler & Drasar, 1996b). Likewise in Peru they were neither dirty nor contaminating (Fukumoto *et al.*, 1989). In Pakistan, children's faeces only became dirtier as they began to crawl and eat solid food (Halvorson, 2004). This has led some to suggest that such perceptions influenced the lack of hand-washing after nappy change in pre-crawling children (Curtis *et al.*, 2003; Scott *et al.*, 2003).

Following that logic one would expect hand-washing after handling children's faeces to be perceived as important, but it was not the case in this study. There were three junctures when hands were expected to be washed. Firstly when they were likely to take impurity into food, which was important even if there were no signs of hands being dirty. Secondly, when there were traces of smell or dirt, and thirdly, after using the latrine. Handling of children's faeces did not emerge as an important juncture.

Danger was the main deterrent of latrine use by children. However, from the quantitative data on hygiene and sanitation practices (Chapter 7), it was seen that only 9% of the visited latrines had an open pit where a small child could easily fall. The majority of latrines had a seat or slab with an opening not big enough to allow a small child to enter. Besides suggesting that danger might not have been the key underlying factor allowing open defecation, from the observations it was sensed that caretakers' time and convenience played a role in favouring the practice, because by teaching the child to defecate on a corner the caretaker would not have to interrupt her chores immediately to attend the child on every defecation episode, leaving the subsequent cleaning of the child and the removal of faeces to a time more convenient to her. Teaching the child to use the latrine would be more difficult, which brings to another reason stated by caretakers, which was that children were not able to aim at the hole, therefore mothers found it less laborious and less messy to clean up their children's stools from the floor than from the latrine slab.

On the front of sanitation technologies, as shown in Chapter 7, the majority of households in this setting had latrines. Therefore one would anticipate lack of concern, from the participants' side, with regard to the topic of motivators for latrine possession. In Burkina, Curtis found that study participants initially saw no point in discussing cleanliness because "everybody wants to be clean" (V. Curtis, personal communication). On the contrary, in Manhiça people were very keen to debate on the subject of latrine possession.

Sense of accomplishment, which is a clear psycho-social characteristic, emerged as an important driver, both for the acquisition of traditional latrines and the upgrading to an improved, commercially acquired latrine, suggesting that the desire to acquire higher levels of social and psychological satisfaction reoccurs as a motivation for different stages in the process of sanitation improvement. This finding feeds into the notion of consumer drives in the context of decision-making processes for latrine acquisition (Jenkins & Curtis, 2005). In such process, Jenkins and Curtis captured a desire to reach the ideal state of lifestyle in rural Benin (Jenkins & Curtis, 2005). This ideal state is equivalent of the sense of completion as an adult male, which was captured by the data in the present study. Those drives were characterized as desires that people have which assist them into shifting from a current, less satisfactory state of affairs (in this case of possessing a latrine made of traditional or recycled materials) into to an ideal state (possessing a modern latrine) conforming with personal goals and values, in this case the state of *completeness*, which gives prestige.

The above finding also ties in with other explanations of need, perhaps the most popular of these being the Hierarchy of Needs motivational model (Maslow, 1954), which organises needs by placing the basic ones at the bottom and the higher needs at the top. The starting point in this theory is that most people tend to satisfy physiological, safety, love, esteem, and finally self-actualisation needs. The latter is the need of self-fulfilment, which seems to be what was dominating the intention for sanitation improvement in this study.

Although the importance of wealth was found to be debatable amongst respondents, it cannot be considered less important than for example self-reliance, because it is not easy to separate the two. In the terms of the respondents, diminished self-reliance, which brings up the matter of autonomy, was closely associated with living alone or with having no male partner, which in turn might be linked to having limited sources of income. This is concordant with data from Mali, which suggested that autonomy could evolve with marital and reproductive careers of women (Castle, 1993), by discovering that head wives and mothers of grown sons living with them showed better degrees of support and autonomy than other women.

On the other hand, it was more acceptable that bednet possession status be attributable to financial situation. Less judgemental social attributes were related to this status, namely habit, lack of initiative and product preference, showing that in this category of behaviour conduct people were allowed to choose their path at their own risk.

One intriguing finding however was the link between good fortune and economic advantage, with regards to bednet acquisition, a relationship that was questioned, and considered contradictory, in Chapter 8. That chapter held that households of higher economic status were more likely to be bednet users. Yet, through information given by village authorities, field workers and health personnel suggested that at the time this research was conducted, most bednets had been donated during the then recent floods. This would imply that households would have bednets regardless of their economic status. However, it reoccurs in this part of the study that the luck talked about here and economic status could possibly relate, because owners of donated bednets primarily attributed poverty to those who did not have bednets. This could mean that, rather than misfortune, the likelihood of being on the bednet distribution list was dependent on holding personal networks of influential people. Educated and wealthy people managed better to use the system to their own advantage. This phenomenon is concordant with the relationship between amplitude of social networks and successfulness in treatment seeking identified in

Bangladesh (Lindenbaum *et al.*, 1989). Alternatively it is possible that distribution of nets was equitable but the poorer households resold them, as has been found following bednet distribution elsewhere (Twebaze, 2001; Van Bortel *et al.*, 1996).

Cleanliness and organisation of the yard emerged as a much valued domestic hygiene variable, which carried numerous social implications for women. A clean yard increased a woman's value, aesthetics, and prestige, very similarly to the social connotations found to be carried by latrine possession and hand-washing elsewhere (Curtis *et al.*, 2003; Fukumoto *et al.*, 1989; Jenkins & Curtis, 2005; Kaltenthaler & Drasar, 1996b; Rauyajin *et al.*, 1994; Scott *et al.*, 2002). An interesting finding was that cleanliness of the yard was used as "meter" for other, less visible, domestic hygiene behaviours. People automatically associate clean yards with clean drinking water, safe food, and even mosquito avoidance and clean air. This insight encourages the debate raised in Chapter 9 that certain HHEH practices tend to occur in clusters, and adds that such clustering is apparent also from the lay perspectives of HHEH.

Perceived links between HHEH practices and health were captured but they were diluted amidst other connotations of social and psychological character. However, it can be proposed from the data that health preservation was an important component in people's perceptions of benefits from latrines and bednets but not so much in terms of hand-washing with soap. However, since malaria was not explicitly mentioned all the time, it cannot be argued that the health constructs in question were equivalent to the biomedical reasoning which, as held by Nettleton (2002), adopts a mechanical outlook on health and disease by using technology to fix (or in this case prevent) specific medical problems. In contrast, in the lay perspective captured here, mosquito deterrence was viewed as a solution to a broader aspect of health, which encompassed a good disposition for work after a good nights sleep, which means that health is viewed not only as the absence of disease but the ability to function or to fulfil a role (e.g., as a productive head of the household). This is the holistic view of health, which besides being related to biophysical status, is related to a wide

socio-economic context and called the social model of health disease and illness (Nettleton & Gustafsson, 2002).

10.6 Conclusions

This chapter tied some aspects in with the findings from the other chapters concerned with patterns of HHEH practices (Chapters 7, 8, and 9).

Components of biomedical environmental health risks, such as mosquito bites and exposed stools, were perceived as risks, not only to the specific health problems related to them (i.e., malaria or diarrhoea) but to broader spectra of health. Nonetheless, other drives dominated the pursuit of protective practices, especially the use of bednets and latrines.

Not possessing a latrine or a bednet was linked to lack of initiative and modernism. Not possessing a latrine was further associated with lack of authority, social commitment, completeness, value for self, self-reliance, and self-organisation. Therefore on the whole sanitation practices carried moral connotations that mosquito avoidance practices did not.

Education, which was suggested by the quantitative chapters to be importantly associated with the practices in question, especially latrine possession, did not emerge as an important characteristic underlying them, from the lay perspective. On the other hand, wealth did emerge in this chapter as a factor associated with bednet and latrine possession. However, the importance of wealth was brought about in synergy with other states of affairs, namely self-reliance and good fortune.

Interestingly, the earlier suggested clustering of hygienic behaviours (Chapter 9) re-emerges here, in particular with respect to the association that people make between maintaining a clean yard, food hygiene, and drinking water quality, suggesting that there might be a degree of consciousness, enforced by social values, behind putting a certain number of seemingly unrelated behaviours in place concomitantly.

Some strengths and weaknesses of the study were identified.

Inquiring what the respondents thought of other people with a particular behaviour conduct that differed from theirs was the main approach used to question perceived factors underlying the acquisition of environmental health hardware (in particular latrines and bednets). This approach uniquely assisted in revealing sets of norms or rules that people generally tried to conform with, rather than disclosing of personal excuses not to follow the behaviours under investigation by for example asking "why don't you have a latrine?"

Never the less, it was a constant battle to let go of the perspective of the researcher because although the purpose was to gain insights into the participants views, it was inevitable that the questions be formulated on biomedical grounds, which was the knowledge base of the PI. This undoubtedly influenced the set up of the coding process, and the initial theoretical organisation of ideas, despite the fact that the approach used was borrowed from grounded research (Glasser & Strauss, 1967).

Despite the relatively small sample size in comparison with other studies on similar broad subjects the elucidation of many themes reached the saturation point early on in the course of the analysis process. In instances where contradictions seemed to emerge, the number of opposing opinions remained within a defined range of possibilities and further coding did not add new information. This does not imply that the level of accuracy of the data was guaranteed, but that elements in a fraction of the world constructed and shared by the people under investigation were captured.

The recording approach did not generate rich enough data for pure grounded theory to be exercised. However, the researcher herself constituted a strong tool for the data collection process being herself a descendent of the Ronga and Chope ethnic groups, which share a lot of cultural similarities with the Changan people. Further, the field assistants were local. For instance, because many terms and ideas emerging from the FDGs and interviews were already familiar to the PI and the field assistants, FDGs were very productive in generating data since not much time was spent to understand and familiarise

with the context of the study setting, which initial FGDs in many social science studies are mostly employed for.

Nonetheless, there is a need for further data to be collected to allow further steps in the grounded approach initiated in this study. Such steps are deduction and verification (Green & Thorogood, 2004), to confront the new theoretical constructs emerging from this study. The new data should come from a larger number of sources to allow room for sampling on a theoretical basis, whereby relevant subtypes of respondents (e.g., according to their demographic or social characteristics) are included in order to allow comparisons.

New components to the earlier developed tool to measure dimensions of female autonomy are suggested by this study, namely self reliance, and determinism which can be further investigated, quantitatively in conjunction with patterns of HHEH practices.

Chapter 11 General Discussion, Conclusions and Implications

11.2 General discussion and conclusions

In this final chapter, the results of the 4 data chapters (chapters 7 through to 10) are recapitulated, limitations of the study are considered, and an account of the implications of the results is given both from the point of view of health policy recommendations for Manhica and with respect to future research.

The present study quantitatively documented risk and protective Household Environmental Health practices related to the transmission of malaria and infectious diarrhoea, and explored relationships between wealth, female education, and autonomy and HHEH outcomes.

Particularly it was found that:

- 95% of households had a latrine installed in their yard
- Soap was available in 86% of households
- 62% of households had access water from taps
- Hand-washing with soap was observed on 6% of occasions after potential faecal contact
- Children's stools were disposed of in the latrine on 6% of occasions after open defecation events.

The data show that HHEH practices can be predicted by socio-economic variables characterising households and caretakers. However, HHEH encompass a diversity of practices, therefore it would be futile to attempt to reach a single conclusion on factors predicting HHEH practices as a whole. The following points summarise what was found in terms of factors associated with HHEH practices:

- Caretaker's education predicted latrine ownership

- Access to soap was associated with caretaker's education, caretaker's exposure to information and wealth.
- Wealth and type of water source were associated with safe disposal of stools.
- The likelihood that children under 5 were protected by any deterrence method increased with increased caretaker's education and decreased proximity to maiden family.
- Use of traditional fumigation in the child's bedroom was associated with decreased wealth in the sense of accumulation of modern assets, but with increased accumulation of traditional assets.
- Protecting children under 5 with commercially available products other than bednets was associated with caretaker's education and financial independence.
- Bednet use by children was predicted by increased wealth and decreased proximity of caretaker to her maiden family.

The sections below synthesise the major findings, discussing them and tying them in with the existing and related body of knowledge.

11. 2. 1 The behaviour profile of the study population

Most houses in the present study (82%) had soap, mostly used for activities other than hand-washing. Rates of hand-washing with soap after critical events were low (6%). This prevalence is amongst the lowest, compared to previously published hand-washing rates after cleaning the child (Scott *et al.*, 2003). The lowest recorded has been in rural Kyrgyzstan (Biran *et al.*, 2005). However, care should be taken if attempts to rank these populations according to their hand-washing practices, because firstly none of those studies were country representative surveys and secondly sampling strategies have been different and different ways of applying direct observation in different settings might give different results.

Ninety-five percent of the households had a functioning latrine within the yard. Yet, practices likely to contribute to faecal contamination of the household environment were observed, namely, open defecation by children and subsequent unsafe disposal their stools, soiled nappies, and anal cleansing materials.

The most common mosquito deterrence practice covering children under-5 was traditional fumigation, followed by use of mosquito coils and aerosol sprays. Bednet use by children was low, ranging from 4% in the dry season to 15% in the rainy season. Only 0.2% of children had used ITN.

This exercise not only provided with the outcome variables for this study but also was important as such to identify prevalent behaviours, which in this setting could conceivably be putting children at risk from malaria and diarrhoeal disease. The data show that rates of proven protective practices of interest to this study are low.

11. 2. 2 The role of women's education

The conceptual framework (section 3. 4. 2) predicted education to be associated with presence and use of commercially-available HHEH products because of the relationship between education and modernisation. However, it seemed from this study's results that education predicted presence but not use of certain HHEH products.

Previous studies have cumulatively not shown significant associations between women's education and sanitation behaviours in general (Barrett & Browne, 1996; Curtis *et al.*, 1995; Gorter *et al.*, 1998). By finding no association between safe stool disposal and women's education this study adds support the above evidence base.

Evidence for the link between hand-washing practices and education has been scarce and conflicting (Gorter *et al.*, 1998; Hoque *et al.*, 1999). The present study detected no association between hand-washing and women's education, supporting the findings by Gorter (1998). Nonetheless the extremely low levels

of hand-washing detected in the present study cast doubt on the strength of the evidence against this link.

On the other hand, women's education proved an important predictor of availability of hygiene and sanitation facilities in the homes. Firstly, not having a latrine was strongly associated with low women's educational status. Secondly, the results indicate that caretaker's education was an important predictor of soap availability. No study had been found specifically investigating links between female education and latrine possession. Likewise, to the author's knowledge this was the first time that a study reported predictors of soap availability at home in general and the role of education in particular. Therefore the study provides an important contribution towards addressing this knowledge gap.

The balance in the existing evidence tends to suggest a positive association between education and mosquito deterrence practices in general (Govere *et al.*, 2000; Howard *et al.*, 2003; Macintyre *et al.*, 2002; Ziba *et al.*, 1994). However the evidence has been weak in the sense that most did not take into account possible interactions between education and wealth. The studies that did so showed a mix of non-supportive (Aikins *et al.*, 1993; Nuwaha, 2001) and supportive evidence (Macintyre *et al.*, 2002) for this association. The literature on determinants of mosquito deterrence practices specifically covering children under-5 is lacking, as studies investigating the particular role of women's education are rare. The present study showed an association between caretaker's education and the use of any mosquito deterrence product to protect children. When the type of product was taken into account, this association only remained for mosquito coils and aerosol sprays but not for bednets.

11. 2. 3 The role of wealth

The study provided evidence for an association between wealth and all aspects of safe stool disposal, which is concordant with the existent studies (Curtis *et al.*, 1995; Tumwine *et al.*, 2003). This practice was also associated with the type of water source, in that those using water from wells, pumps or springs

were 3 times less likely to have grounds clear of human faeces compared to those using taps. This was partly in line with Curtis' findings from Burkina Faso, but while that study suggested that both water source type and location (i.e., tap in the yard) predicted safer stool disposal practices, this study suggests that the type of water source is an important factor, regardless of its location in relation to the house. Findings from the present study suggest an element of status, rather than time or availability of more water for hygiene behaviours, operating in the relationship between wealth and safe stool disposal.

Similar to education, wealth was not related to hand-washing after handling children's faeces. Neither type nor location of water source, which this study considered both a wealth indicator and a hand-washing convenience factor, was associated with hand-washing, opposing Curtis' result that tap in the yard predicted more hand-washing after cleansing child's bottom (Curtis, 1995). However those results were not adjusted for other socio-economic variables, casting some doubt on the validity of such finding. On the other hand in Brazil no significant difference was detected between the distribution of positive water-using behaviours between households with and those without piped water in the house (Strina *et al.*, 2003). Likewise in Peru socio-economic characteristics were not related with hand-washing after handling faeces. The present study unites to those two studies in showing no evidence for a link between hand-washing at critical times and wealth.

According to the vast literature on latrine ownership, it has been assumed that this characteristic is closely related to wealth. Surprisingly, publication of studies reporting empirical evidence for this relationship is scant. This study found no evidence for this relationship, and qualitative results added to the idea that latrine acquisition in this setting might be costless. Such finding contrasts a study from elsewhere, which established a significant association between farming occupation and not having a latrine in Kenya, Uganda and Tanzania (Tumwine *et al.*, 2003). Similarly to Manhiça, in those settings latrine coverage was high.

Compared to education, the existing evidence depicting the association between wealth and mosquito deterrence is more consistent and suggestive towards a positive association between those variables (Agyepong & Manderson, 1999; Aikins *et al.*, 1993; D'Alessandro *et al.*, 1994; Dgedge, 2000; Lukwa *et al.*, 1999; Nuwaha, 2001; Ziba *et al.*, 1994).

In this study, no wealth indicator differentiated between those that engaged in any mosquito deterrence practice in protection of children from those that did not. However, taking into account different practices, while wealth did not predict use of coils or aerosol sprays, bednet use by children was associated with higher scores of head of household socio-economic status and household accumulation of modern assets, and using *sule* was associated with lower scores of these attributes. This meant that children in wealthier households were more likely to have been covered against mosquitoes by bednets and less likely by *sule*. This association was partially predicted by the conceptual framework (section 3.4.1), in that wealth was directly associated with use of modern products but inversely associated with use of traditional products, but while the conceptual framework expected this relationship to hold with respect to any modern product, the results suggest that it is only valid in relation to bednet use.

11.2.4 The role of women's autonomy

One factor earlier suggested to influence health protective behaviours grounded on some evidence, has been women's autonomy (Castle, 1993; Hakim *et al.*, 2003; Molyneux *et al.*, 2002; Pfeiffer *et al.*, 2001). There were no published studies empirically measuring associations between HHEH practices and autonomy of women, despite the fact that speculations for this association existed (Agyepong & Manderson, 1999; Halvorson, 2004), with one exception which demonstrated a significant association between household use of ITNs in Benin with women's participation in communal organisations as an expression of exposure to the world beyond the household (Rashed *et al.*, 1999).

Different dimensions of women's autonomy were considered in this study, namely decision-making power, proximity to own family, financial autonomy and exposure to information, as discussed in the study's conceptual framework (sections 3.4.3 and 3.4.4). Perhaps amongst those the most direct indicators of women's autonomy were decision-making power and financial autonomy.

There was no evidence in this study to suggest that decision-making power was associated with hand hygiene, safe stool disposal or mosquito deterrence practices to protect children. On the other hand, financial autonomy of caretakers was a predicting factor for the use of aerosol sprays and mosquito coils for children. This can mean that these particular products, specifically to be allocated to children, are not part of the household collective budget, therefore independent of overall household wealth, but on whether women have ever-available cash of their own for such initiative. In contrast, soap might depend on the household budget; therefore those in lower wealth strata are less likely to have it available.

One further autonomy variable, increased *caretaker's proximity to own family*, was significantly associated with the less use of any mosquito deterrence product to protect children, and in particular with the use of a bednet for that purpose. Two likely explanations to this were suggested. The first being that women living with their partners, away from the maiden families, were most likely to be at the centre of a nuclear, more stable family where their husbands were heads of household and their children were among the prioritised beneficiaries of health-protective efforts. Secondly, that those caretakers who lived with their husbands and away from their families were more likely to incidentally draw the child closer to the breadwinner at bedtime due to the three of them sharing a bed or bedroom, therefore the child benefited incidentally from mosquito deterrence practices. There has only been empirical data to back the latter suggestion (Mugisha & Arinaitwe, 2003).

11.2.5 Clustering of behaviours

One of the study objectives was to explore the role of HHEH practices and state of affairs themselves in predicting other HHEH practices by carrying out an investigation of behaviour clustering.

Identical to other health related behaviours (Røysamb *et al.*, 1997), there was some evidence from the present results that hygiene and sanitation behaviours can occur in coherent patterns of covariance. Two HHEH components were revealed namely *avoiding dirt* and *order in the yard*. In other words, households with tendencies of safely disposing of children's faeces were also likely to safely store water, wash hands after faecal contaminative events, and maintain the latrine unsoiled with the drop hole covered. On the other hand, households with tendencies to keep yards swept also placed all kitchen utensils off the floor.

Interestingly, there were indications from the qualitative study of a degree of consciousness behind the clustering of hygienic behaviours, as people made judgements on household's attention to water and food hygiene, based on the cleanliness and organisation of the yard.

Earlier studies suggested clustering of certain Environmental Health practices (Alam *et al.*, 1989; Dearden *et al.*, 2002; Kaltenthaler & Drasar, 1996a; Milroy *et al.*, 2001; Westaway & Viljoen, 2000), but only 2 reported use of powerful statistical analysis approaches specially designed to investigate clustering of variables (Milroy *et al.*, 2001; Westaway & Viljoen, 2000). The present study adds to that list of studies, which are important since the use of indexes of HHEH practices to rate households according to their behaviour conduct is gaining currency (e.g., Armar-Klemesu *et al.*, 2000; Barrett & Browne, 1996; Gorter *et al.*, 1998; Strina *et al.*, 2003).

11. 2. 6 Other possible factors explaining HHEH

Investigation of lay perspectives of HHEH was of value to suggest further drivers for HHEH protective practices, with particular focus on use of bednets and latrines.

Biomedical risks such as mosquito bites and exposed stools, were perceived by the participants as risks, not only relating to the specific health problems related to them (i.e., malaria or diarrhoea) but were important in a broader context of health.

Besides health, moral connotations emerged as important, more so with regard to latrine possession and use than to mosquito deterrence practices. Connotations that were particular to latrine possession were lack of: authority, social commitment, value for self, self-reliance, self-organisation, and completeness. Good fortune was particularly related to bednet possession. Lack of initiative and modernism were characteristics associated with both not having bednets and not having latrines. It can be concluded that all of those characteristics are of psycho-social nature.

11. 3 Study strengths and limitations

An important limitation to consider is inherent to the type of study design. It was designed as an analytical cross sectional study, which sought to determine associations between specific variables and behaviour outcomes. Causality of such associations could not be guaranteed, firstly because it was an observational study and secondly because the statuses of the individuals and households with regard to the presence of the "exposure" and the "outcome" were measured at the same point in time.

Nevertheless the current values of the exposures under investigation (i.e., wealth, education and autonomy) are not easily changeable, and are often long term and relatively stable characteristics, unlikely to be influenced by the type of behaviour conducts here investigated. Therefore speculative explanations to the associations found could be confidently provided, leading

to the formulation of reasonable hypotheses for future testing (Henekens & Buring, 1987).

Still related to causation, the study design and analysis did not allow for a distinction between intermediate and end point variables in potential causal pathways, in cases where more than one explanatory variable remained significantly associated with the outcome. Nonetheless, the study was strong in the sense that rigorous control for a wide range of variables was allowed, which was an improvement from a number of previous studies investigating factors associated with HHEH practices (as can be seen from tables 3-1 through to 3-4, Chapter 3).

An alternative to this study design would be an interventional study design to investigate the effect of improved education, wealth or autonomy on the HHEH practices. An intervention-control study, i.e., delivering education, empowerment or wealth-related improvements to one set of households comparing to another set where no intervention is delivered could run into ethical problems. However, there could be ways around that, for example by making social adjustments with a stepped-wedge design, or designing a before and after study. Both these interventions would address the ethical issues because they would ensure that the entire study population benefited from the intervention, but neither approach would have been feasible considering the time restrictions faced by the study.

This study made use of one of the best-known forms of measuring hygiene behaviour: structured observations. By using this approach over questionnaires it was more likely to address the problem of recall biases and respondent bias (e.g., over reporting perceivably desirable practices).

Set against the above strength of structured observation were three limitations: observer bias, sample size restrictions, and reactivity of participants. Reactivity is a problem because "the observer is rarely invisible and may have profound effects on the subjects" (Martin & Bateson, 1986), therefore giving no basis to guarantee recording of actual behaviours similar to those carried outside the setting of the research. Reactivity has been suggested to be curtailed

by repeated visits to build rapport (Manun'Ebo *et al.*, 1997), which was the strategy used in this study. Like in previous studies (e.g., Cousens *et al.*, 1996) it was not felt that participants were making an effort to change the behaviours the study was interested in, for example hand-washing rates in the present study were expectedly low (based on estimations from previous studies). Yet an even stronger design would allow more rounds of observational visits to empirically ascertain the reactivity issues.

Minimal sample sizes were calculated, but these sizes only allowed a detection of a 30% difference in the outcome of interest between the exposed and unexposed groups. Logistic constraints did not allow a sample larger than that stipulated. A stronger design would have had a larger sample size.

Observer bias was a matter seriously taken into account during the training. As detailed in Chapter 4 (sections 4.7 and 4.8), observers were paired up to carry out independent, but simultaneous observations in order to reduce inter-observer variability until the PI was satisfied with the consistency. After the training, quality assurance strategies were put in place, namely daily the PI paired up randomly with one of four field assistants, all observation sessions were rounded off by debriefing with the PI immediately after returning from the field, and completed structured observation record sheets were checked daily for inconsistencies and corrected accordingly.

Despite the possible variability of behaviours due to the various biases discussed, it is held that data obtained through structured observation reliably represent exposure levels at population level (Cousens *et al.*, 1996), therefore it can be said with some confidence that the prevalences obtained can be close to the reality.

With regard to the qualitative study, the data was not rich enough for pure grounded theory to be exercised. Nonetheless, some of the results fed into the interpretation of the associations quantitatively established in earlier chapters, for example the role of wealth in latrine and bednet acquisition, and factors underlying clustering of behaviours. Further, for most of the behaviours under investigation, at least two perspectives of the problem were captured,

namely the lay perspective and that dictated by social science theories and biomedical reasoning.

All in all, it can be argued that a reliable description of practices and exploration of potential factors independently associated with each practice was accomplished.

11.4 Implications

In a country like Mozambique where latrine coverage is estimated at just under 40% (UN, 2000), the coverage of 95% found in the study setting is an exception. However it is a good example to illustrate that the case for sanitation improvement is not closed by the mere achievement of universal latrine coverage in African rural areas, where latrine designs are not encouraging for children. Therefore measurements of "sanitation" in the light of the MDG of halving the people without sanitation by the year 2015, should take into account sanitation for children in the homes.

The results suggest that adequate removal of child's faeces had potential of being incorporated with ease in messages highlighting the social value associated with a clean yard. One intervention worth considering would be the introduction of potties to decrease faecal contamination in the yard area (Huttly *et al.*, 1994). In Burkina Faso, 70% of toddlers already used potties (Curtis *et al.*, 2001). Trials to assess the acceptability of potties Peru, where only a minority were already using them, were encouraging (Yeager *et al.*, 1999). However nothing is known regarding acceptability of this specific practice in the particular context of this study.

The results are indicative that widespread hand-washing with soap behaviours are far from being achieved, therefore hand-washing urgently requires promotion. Different strategies have been considered for the implementation of hand-washing for the reduction of diarrhoeal disease (Luby *et al.*, 2005; Scott *et al.*, 2002). However, their focus in terms of necessary hardware to facilitate the process has been soap availability. In this study

physical barriers beyond the presence of soap were identified. It is of view from the results of this study that in an area such as Manhiça, approaches should allow availability of acceptable hand-washing facilities such as washstands.

The absence of an association between decision-making power and all HHEH practices under investigation, and financial autonomy and most practices may suggest that the practices under investigation might not be subject to conflicts of interest between powerful and less powerful householders, therefore from the policy perspective, programs aiming at female empowerment status are not likely to impact on their environmental health practices.

As to the factors found important predictors of HHEH practices, it is not to say that it is suggested that those variables serve as policy instruments to behaviour change. Changing the educational or wealth status of an entire population is an overly ambitious short- and long-term goal. Instead, such results were more useful to characterise groups of people likely to carry out risk practices in order to easily identify them under intervention settings, for example in order to target more intensive techniques for behaviour change with regards to safe stool disposal at households of low socio-economic status in comparison to the rest of the target population, emphasising costless latrine construction among less educated women, and alleviating the constraints faced by those less able to build their own latrines, subsidising soap costs for the poorer sectors of the community, and subsidising bednet costs for those less wealthy and single women with children. Caution must be taken in order for this highly targeted subsidisation not to contribute to stigmatisation of vulnerable groups.

Finally, the observed clustering of hygiene and sanitation behaviours raises methodological questions from the epidemiological perspective as well as implications from the behaviour change point of view. The epidemiological implication is that regarding studies of the effect of single behaviours (for example hand-washing with soap) on diarrhoeal disease outcome. The clustering suggests that specific stool disposal and domestic water management

practices be taken into account as confounders of the effect of hand-washing, especially in non-interventional studies, since these practices are shown to naturally co-vary with hand-washing. Regarding hygiene promotion implications, the finding supports the thesis of holistic approaches to behaviour change, such as community health clubs, which target a large number of health-related behaviours to change (Waterkyn & Cairncross, 2005). However, such approaches could run into problems of feeding people with numerous, seemingly unrelated messages, making the overall message difficult to be absorbed, as defended by Curtis (1998), who held that there is only the need to target a minimal number of hygiene practices. To overcome the problem, perhaps holistic approaches to behaviour change should target clusters of behaviours, following the "logic" revealed by analyses of behaviour clustering such as the one here presented. On the other hand, it also implies that in behaviour change programs targeting single behaviours, a number of behaviours known to cluster with the one being targeted may be predicted to be changed. This implication on behaviour change programs should be interpreted with caution, because the study found clustering of behaviours among households already motivated to perform such behaviours, which may vary systematically from those households not yet performing any of the target practices, therefore there is the possibility that clustering might not occur in households in which the behaviours still need to be introduced by an intervention.

11.5 Future research

The results revealed by this study touch on a range of areas of interest for further research.

Studies are needed investigating the acceptability of the interventions proposed, namely trials that investigate acceptability of potty use by children

between 1 and 5 years, and acceptability of different forms of hand-washing facilities in the homes.

Enabling factors for hand-washing remain imprecise and need to be further explored. The positioning used in the qualitative study (Chapter 10) proved useful in revealing enablers and inhibitors of latrine and bednet acquisition and use. A similar approach is proposed to investigate hand-washing drivers and constraints.

In this study financial autonomy, exposure to information, and proximity to husband's family were important predictors of some HHEH practices. There are no accounts of studies investigating conflicts of interest amongst householders with regards to giving priority to practices specific to preserve children's health. Do conflicts of interest exist in most households, i.e., men are generally less interested in the health outcomes of their children, resulting in more autonomous women being more successful at pursuing health protective practices as an outcome of an effective bargaining process? Or is it the case that men in households with autonomous women are also more likely to follow effective treatment and protective practices, therefore no conflicts of interest exist, therefore women do not use their autonomy endowments anyway?

The only outcome variable that showed an association with women's exposure to information was soap availability. This merits further investigation from the standpoint of the role of mass media in the promotion of products linked to HHEH. Studies investigating this point would be of value in assessing whether there are specific messages that are successfully reaching a specific group of households, hence informing social marketing programs.

On the front of tool development, in order to clarify whether variability of directly observed behaviour holds after intensive training and close supervision, and to address the question of repeatability, further analysis of repeated measurements has been planned. Data from the first, second and third round of structured observations will be compared using kappa statistic (Fleiss,

1981). Methodological studies addressing the problems encountered by the use of structured observation to measure hygiene practices are still needed.

References

- Adetunji, J. (1995).** Infant mortality and mother's education in Ondo state, Nigeria. *Social Science & Medicine* **40**, 253-263.
- Afifi, A. & Clark, V. (1984).** *Computer-aided multivariate analysis*. Belmont, CA: Wadsworth.
- Agyepong, I. (1992).** Malaria: ethnomedical perceptions and practice in an Adangbe farming community and implications for control. *Social Science & Medicine* **35**, 131-137.
- Agyepong, I. & Manderson, L. (1999).** Mosquito avoidance and bed net use in the Greater Accra Region, Ghana. *Journal of Biosocial Science* **31**, 79-92.
- Aikins, M., Pickering, H. & Greenwood, B. (1994).** Attitudes to malaria, traditional practices and bednets (mosquito nets) as vector control measures: a comparative study in five West African countries. *Trop Med Hyg* **97**, 81-86.
- Aikins, M., Pickering, H., Alonso, P. L., D'Alessandro, U., Lindsay, E., Todd, J. & Greenwood, B. (1993).** A malaria control trial using insecticide-treated bed nets and targeted chemoprophylaxis in a rural area of the Gambia, West Africa. *Transactions of the Royal Society of Tropical Medicine and Hygiene* **87**, 25-30.
- Alaii, J., Van Den Borne, H., Kachur, S., Mwenesi, H., Vulule, J., Hawley, W., Meltzer, M., Nahlen, B. & Phillips-Howard, P. (2003a).** Perceptions of bed nets and malaria prevention before and after a randomized controlled trial of permethrin-treated bed nets in western Kenya. *Am J Trop Med Hyg* **68**, 142-148.
- Alaii, J., Hawley, W., Kolczak, M., Kuile, F., Gimnig, J., Vulule, J., Odhacha, A., Oloo, A., Nahlen, B. & Phillips-Howard, P. (2003b).** Factors affecting use of permethrin-treated bed nets during a randomized controlled trial in western Kenya. *Am J Trop Med Hyg* **68**, 137-141.
- Alam, N., Wojtyniak, B., Henry, F. & Rahaman, M. (1989).** Mother's personal domestic hygiene and diarrhoeal incidence in young children in rural Bangladesh. *International Journal of Epidemiology* **18**, 242-247.
- Alonso, P. & Dgedge, M. (1999).** A new impetus for malaria research control. *Parasitology Today* **15**, 48-49.
- Alonso, P., Saute, F., Aponte, J., Gomez-Olive, F., Nhacolo, A., Thompson, R., Macete, E., Abacassamo, F., Ventura, P. J., Bosch, X., Menendez, C. & Dgedge, M. (2002).** Manhiça DSS, Mozambique. In *Population and Health in Developing Countries: Population, Health, and Survival at INDEPTH Sites*, pp. 189-195. Ottawa: International Development Network.

- Altman, D. & Bland, J. (1994).** Quartiles, quintiles, centiles, and other quantiles. *BMJ* **309**, 996.
- Altmann, J. (1974).** Observational study of behavior: Sampling methods. *Behaviour* **49**, 227-267.
- Ardeni, P. (1999).** Economic Growth in Mozambique? An assessment.: Department of Economics, University of Bologna.
- Armar-Klemesu, M., Ruel, M., Maxwell, D., Levin, C. & Morris, S. (2000).** Poor maternal schooling is the main constraint to good childcare practices in Accra, pp. 1598-1607: American Society for Nutritional Sciences.
- Armstrong, J. & Soelberg, P. (1968).** On the interpretation of factor analysis. *Psychological Bulletin* **70**, 361-364.
- Arnfred, S. (2001).** Family forms and gender policy in revolutionary Mozambique (1975-1985). Bordeaux: Centre D'étude D'Afrique Noire.
- Aziz, K. M. A., Hoque, B. A., Huttly, S. R. A., Minnatulah, K. M., Hasan, Z., Patwary, M. K., Rahaman, M. M. & Cairncross, S. (1990).** Water supply, sanitation and hygiene education: Report of a health impact study in Mizapur, Bangladesh. Washington, D.C: UNDP - World Bank Water and Sanitation Program.
- Baden, S. (1997).** Post conflict Mozambique: Women's special situation, population issues and gender perspectives to be integrated into skills training and employment promotion. Geneva: International Labour Organization.
- Baker, R. & Hinton, R. (1999).** Do Focus Groups Facilitate Meaningful Participation in Social Research? In *Developing focus group research: Politics, theory and practice*, pp. 79-98. Edited by R. Barbour & J. Kitzinger: Sage Publications.
- Baltazar, J. & Solon, F. (1989).** Disposal of faeces of children under two years old and diarrhoea incidence: a case-control study. *International Journal of Epidemiology* **18**, S16-S19.
- Baltazar, J., Briscoe, J., Mesola, V., Moe, C., Solon, F., Vanderslice, J. & Young, B. (1988).** Can the case-control method be used to assess the impact of water supply and sanitation on diarrhoea? A study in the Philippines. *Bull World Health Organ* **66**, 627-635.
- Bandura, A. (1989).** Human Agency in Social Cognitive Theory. *American Psychologist* **44**, 1175-1184.
- Barrett, H. & Browne, A. (1996).** Health, hygiene and maternal education: Evidence from the Gambia. *Social Science & Medicine* **43**, 1579-1590.
- Bartram, J., Lewis, K., Lenton, R. & Wright, A. (2005).** Focusing on improved water and sanitation for health. *Lancet* **365**, 810-812.

- Bates, E., Doig, A., Gitonga, S. & Bruce, N. (2001).** Reducing indoor air pollution in rural households in Kenya: working with communities to find solutions, : ITDG project.
- Behrens, R. (1993).** Diarrhoeal disease: current concepts and future challenges. The impact of oral rehydration and other therapies on the management of acute diarrhoea. *Transactions of the Royal Society of Tropical Medicine and Hygiene* **87**, 35-38.
- Berman, P., Kendall, C. & Bhattacharyya, K. (1994).** The household production of health. *Social Science & Medicine* **38**, 205-215.
- Bern, B. C., Martines, J., Zoysa, I. d. & Glass, R. I. (1992).** The magnitude of the global problem of diarrhoeal disease: a ten-year update. *Bulletin of the World Health Organization* **70**, 705-714.
- Bernard, H. R. (1995).** *Research methods in anthropology: qualitative and quantitative approaches*, 2 edn: AltaMira Press.
- Bicego, J. & Boerma, J. (1993).** Maternal education and child survival: a comparative study of survey data from 17 countries. *Social Science & Medicine* **36**, 1207-1227.
- Binka, F. & Adongo, P. (1997).** Acceptability and use of insecticide impregnated bednets in northern Ghana. *Tropical Medicine & International Health* **2**, 499-507.
- Biran, A., Tabyshaliev, A. & Salmorbekova, Z. (2005).** Formative research for hygiene promotion in Kyrgyzstan. *Health Policy & Planning* **20**, 213-221.
- Black, D. (1980).** Inequalities in health: Department of Health and Social Security.
- Black, R., Morris, S. & Bryce, J. (2003).** Where and why are 10 million children dying every year? *The Lancet* **361**, 2226-2234.
- Blakely, T., Hales, S., Kieft, C., Wilson, N. & Woodward, A. (2005).** The global distribution of risk factors by poverty level. *Bulletin of the World Health Organization* **83**, 118-126.
- Boot, M. & Cairncross, S. (1993).** *Actions speak: The study of hygiene behaviour in water and sanitation projects*. The Hague, The Netherlands.
- Borgerhoff Mulder, M. & Caro, T. M. (1985).** The use of quantitative observational techniques in anthropology. *Current Anthropology* **26**, 323-335.
- Bradley, A., Greenwood, B., Greenwood, A., Marsh, K., Byass, P., Tulloch, S. & Hayes, R. (1986).** Bed-nets (mosquito-nets) and morbidity from malaria. *Lancet* **2**, 204-207.
- Brandberg, B. (1985).** The Latrine Project, Mozambique. Ottawa: International Development Research Centre IDRC-MR58e(Rev.).
- Bryman, A. (1988).** *Quantity and quality of social research*. London: Unwin Hyam.

- Cairncross, S. & Cliff, J. (1987).** Water use and health in Mueda, Mozambique. *Transactions of the Royal Society of Tropical Medicine and Hygiene* **81**, 51-54.
- Cairncross, S. & Feachem, R. (1993).** *Environmental health engineering in the tropics: an introductory text*, 2 edn. Great Britain: Wiley.
- Cairncross, S. & Kolsky, P. (2001).** Environmental health and the poor: our shared responsibility:
<http://www.lboro.ac.uk/well/resources/Publications/DFID%20Publications.htm>.
- Cairncross, S., Blumenthal, U., Kolsky, P., Moraes, L. & Tayed, A. (1996).** The public and the domestic domains in the transmission of disease. *Tropical Medicine & International Health* **1**, 27-34.
- Caldwell, J. (1979).** Education as a factor in mortality decline. An examination of Nigerian data. *Population Studies* **33**, 395-413.
- Caldwell, J. & Caldwell, P. (1985).** Education and literacy as factors in health. In *Good Health at Low Cost*, pp. 181-185. Edited by S. Halstead, J. Walsh & K. Warren. New York: Rockefeller Foundation.
- Campbell, H., Byass, P. & Greenwood, B. (1987).** Bed-nets and malaria suppression. *Lancet* **1**, 859-860.
- Castle, S. (1993).** Intra-household differentials in women's status: household function and focus as determinants of children's illness management and care in rural Mali. *Health Transition Review* **3**, 137-156.
- Cattell, R. (1966).** The scree test for the number of factors. *Multivariate Behavioral Research* **1**, 245-276.
- Charlwood, J., Pinto, J., Ferrara, P., Sousa, C., Ferreira, C. & Rosário, V. (2003).** Raised houses reduce mosquito bites. *Malaria Journal* **2**.
- Chavasse, D., Shier, R., Murphy, O., Huttly, S., Cousens, S. & Akhtar, T. (1999).** Impact of fly control on childhood diarrhoea in Pakistan: community-randomised trial. *Lancet* **353**, 22-25.
- Chen, L. (1978).** Control of diarrheal disease morbidity and mortality: some strategic issues. *American Journal of Clinical Nutrition* **31**, 2284-2291.
- Chin, J. (2000).** Control of Communicable Diseases manual. Edited by J. Chin: American Public Health Association.
- Clarke, S., Bogh, C., Brown, R., Pinder, M., Walraven, G. & Lindsay, S. (2001).** Do untreated bednets protect against malaria? *Transactions of the Royal Society of Tropical Medicine and Hygiene* **95**, 457-462.
- Clasen, T. & Cairncross, S. (2004).** Household water management: refining the dominant paradigm. *Tropical Medicine & International Health* **9**, 187-191.

- Cleland, J. & van Ginneken, J. (1988).** Maternal education and child survival in developing countries: the search for pathways of influence. *Social Science & Medicine* 27, 1357-1368.
- Clemens, J. & Stanton, B. (1987).** An educational intervention for altering water-sanitation behaviours to reduce childhood diarrhoea in urban Bangladesh. *American Journal of Epidemiology* 125, 284-291.
- Cohen, D., Green, M., Block, C., Slepon, R., Ambar, R., Wasserman, S. & Levine, M. (1991).** Reduction of transmission of shigellosis by control of houseflies (*Musca domestica*). *Lancet* 337, 993-997.
- Colin, J. (2002).** The National Sanitation Programme in Mozambique: Pioneering peri-urban sanitation: WSP-AF.
- Coreil, J. (1983).** Allocation of family resources for health care in rural Haiti. *Social Science & Medicine* 17, 709-719.
- Cousens, S., Kanki, B., Toure, S., Diallo, I. & Curtis, V. (1996).** Reactivity and repeatability of hygiene behaviour: structured observations from Burkina Faso. *Social Science & Medicine* 43, 1299-1308.
- Curtis, C. (1989).** Appropriate technology and why it is needed. In *Appropriate technology in vector control*, pp. 1-3. Edited by C. Curtis. Florida: CRC Press.
- Curtis, C. (1991).** Control of Disease Vectors in the Community. London: Wolfe.
- Curtis, C., Lines, J., Carnevale, P., Robert, V., Boudin, C., Halna, J., Pazart, L., Gazin, P., Richard, A., Mouchet, J., Charlwood, J., Graves, J., Hoissain, M., Kurihara, T., Ichimori, K., Zuzi, L., Baolin, L., Majori, G., Sabatinelli, G., Coluzzi, M., Njunwa, K., Wilkes, T., Snow, R. & Lindsay, S. (1989).** Impregnated bed nets and curtains against malaria mosquitoes. In *Appropriate technology in vector control*, pp. 5-46. Edited by C. F. Curtis. Florida: CRC Press.
- Curtis, V. (1998).** The dangers of dirt: household hygiene and health: Wageningen University.
- Curtis, V. (2001).** Hygiene: how myths, monsters and mothers-in-law can promote behaviour change. *Journal of Infection* 43, 75-79.
- Curtis, V. & Cairncross, S. (2003).** Effect of washing hands with soap on diarrhoea risk in the community: a systematic review. *Lancet Infectious Diseases* 3, 275-281.
- Curtis, V., Cairncross, S. & Yonli, R. (2000).** Domestic hygiene and diarrhoea - pinpointing the problem. *Tropical Medicine & International Health* 5, 22-32.
- Curtis, V., Aunger, R. & Rabie, T. (2004).** Evidence that disgust evolved to protect from risk of disease. *Proc. R Soc. Lond. (suppl)*.

- Curtis, V., Cousens, S., Mertens, T., Traore, E., Kanki, B. & Diallo, I. (1993).** Structured observations of hygiene behaviours in Burkina Faso: validity, variability, and utility. *Bulletin of the World Health Organization* **71**, 23-32.
- Curtis, V., Biran, A., Deverell, K., Hughes, C., Bellamy, K. & Drasar, B. (2003).** Hygiene in the home: relating bugs to behaviour. *Social Science & Medicine* **57**, 657-672.
- Curtis, V., Kanki, B., Mertens, T., Traore, E., Diallo, I., Tall, F. & Cousens, S. (1995).** Potties, pits and pipes: explaining hygiene behaviour in Burkina Faso. *Social Science & Medicine* **41**, 383-393.
- Curtis, V., Kanki, B., Cousens, S., Diallo, I., Kpozehouen, A., Sangarè, M. & Nikiema, M. (2001).** Evidence of behaviour change following a hygiene promotion programme in Burkina Faso. *Bulletin of the World Health Organization* **79**, 518-527.
- D'Alessandro, U., Aikins, M., Langerock, P., Bennet, S. & Greenwood, B. (1994).** Nationwide survey of bednet use in rural Gambia. *Bulletin of the World Health Organization* **72**, 391-394.
- Daniels, D., Cousens, S., Makoae, L. & Feachem, R. (1990).** A case-control study of the impact of improved sanitation on diarrhoea morbidity in Lesotho. *Bulletin of the World Health Organization* **68**, 455-463.
- Dargent-Molina, P., James, S., Strogatz, D. & Savitz, D. (1994).** Association between maternal education and infant diarrhoea in different household and community environments of Cebu, Philippines. *Social Science & Medicine* **38**, 343-350.
- Das Gupta, M. (1987).** Selective discrimination against female children in rural Punjab, India. *Popul Development Review* **13**, 77-100.
- de Meer, K., Bergman, R. & Kusner, J. (1993).** Socio-cultural determinants of child mortality in southern Peru: including some methodological considerations. *Social Science & Medicine* **36**, 317-331.
- Dearden, K., Quan, L., Do, M., Marsh, D. & Shroeder, D. (2002).** What influences health behaviour? Learning from caregivers of young children in Viet Nam. *Food and Nutrition Bulletin* **23**.
- Desai, S. & Alva, S. (1998).** Maternal education and child health: is there a strong causal relationship? *Demography* **35**, 71-81.
- Dgedge, M., Novoa, A., Macassa, G., Sacarlal, J., Black, J., Michaud, C. & Cliff, J. (2001).** The burden of disease in Maputo City, Mozambique: registered and autopsied deaths in 1994. *Bull World Health Organ* **79**, 546-552.
- Dgedge, M. C. (2000).** Implementation of an Insecticide Treated Bednet Programme for Malaria Prevention Through the Primary Health Care System in Mozambique: Socioeconomic Factors Associated With Sustainability and Equity. In *ITD*. London: London School of Hygiene & Tropical Medicine.

Donnelly, M. J., McCall, P., Lengeler, C., Bates, I., D'Alessandro, U., Barnish, G., Konradsen, F., Klinkenberg, E., Townson, H., Trape, J.-F., Hastings, I. M. & Mutero, C. (2005). Malaria and urbanization in sub-Saharan Africa. *Malaria Journal* 4.

Dooley, T. (1999). What the Communities of Milange, Pebane, Nacaroa and Mongical Know, Do and Want in Relation to Sanitation and Hygiene Behaviours. Maputo: CFPAS/GNSBC/UNICEF.

Dziuban, C. & Shirkey, E. (1974). When is a correlation matrix appropriate for factor analysis? *Psychological Bulletin* 81.

Ebrahim, G. (2003). Mother and Child Health: Research Methods.

EHP (1999). Behavior Change: Lessons Learned:
http://www.ehproject.org/PDF/Lessons_Learned/behavior_change.pdf.

Emerson, P., Cairncross, S., Bailey, R. & Mabey, D. (2000). Review of the evidence base for the 'F' and 'E' components of the SAFE strategy for trachoma control. *Trop Med Int Health* 5, 515-527.

Emerson, P., Simms, V., Makalo, P. & Bailey, R. (2005). Household pit latrines as a potential source of the fly *Musca sorbens*--a one year longitudinal study from The Gambia. *Tropical Medicine & International Health* 10, 706-709.

Emerson, P., Lindsay, S., Walraven, G., Faal, H., Bogh, C., Lowe, K. & Bailey, R. (1999). Effect of fly control on trachoma and diarrhoea. *Lancet* 353, 1401-1403.

Esrey, S. & Feacham, R. (1989). Interventions for control of diarrhoeal diseases among young children: promotion of food hygiene., pp. 1-22. Geneva: Control of Diarrhoeal Disease Programme, WHO.

Esrey, S., Potash, J., Roberts, I. & Shiff, C. (1991). Effects of improved water supply and sanitation on ascariasis, diarrhoea, dracunculiasis, hookworm infection, schistosomiasis, and trachoma. *Bulletin of the World Health Organization* 69, 609-621.

Evans, P. (1994). Community knowledge, attitudes and practices - urban mosquitoes and sustainable mosquito control. In *LSHTM*. London: University of London.

Ezzati, M., Utzinger, J., Cairncross, S., Cohen, A. J. & Singer, B. H. (2005). Environmental risks in the developing world: exposure indicators for evaluating interventions, programmes, and policies. *Journal of Epidemiology and Community Health* 59, 15-22.

Fauveau, V., Yunus, M., Shafiqul, I., Briend, A. & Bennish, M. (1992). Does ORT reduce diarrhoeal mortality? *Health Policy & Planning* 7, 243-250.

Feachem, R. (1984). Interventions for the control of diarrhoeal diseases among young children: promotion of personal and domestic hygiene. *Bulletin of the World Health Organization* 62, 467-476.

- Ferguson, E. & Cox, T. (1993).** Exploratory factor analysis: A users' guide. *International Journal of Selection and Assessment* 1, 84-94.
- Fewtrell, L., Kaufmann, R., Kay, D., Enanoria, W., Haller, L. & Colford Jr, J. (2005).** Water, sanitation, and hygiene interventions to reduce diarrhoea in less developed countries: a systematic review and meta-analysis. *Lancet Infectious Diseases* 5, 42-52.
- Fleiss, J. (1981).** *Statistical methods for rates and proportions*. New York: John Wiley.
- Foster, G. (1976).** Disease etiologies in non-western medical systems. *American Anthropology* 78, 773 – 782.
- Foster, J. (2001).** *Data Analysis Using SPSS for Windows Versions 8 - 10 : A Beginner's Guide*: Sage.
- Friedman, S. & Aral, S. (2001).** Social networks, risk potential networks, health and disease. *Journal of Urban Health: Bulletin of the New York Academy of Medicine* 78.
- Fukumoto, M., Aguila, R., Kendall, C. & Pederson, D. (1989).** Why do mothers wash their hands? *Dialogue on diarrhoea* 39.
- Gamage-Mendis, A., Carter, R., Mendis, C., De Zoysa, A., Herath, P. & Mendis, K. (1991).** Clustering of malaria infections within an endemic population: risk of malaria associated with the type of housing construction. *Am J Trop Med Hyg* 45, 77-85.
- Gaspar, M. C., Cossa, H., Santos, C., Manjate, R. & Schoemaker, J. (1998).** Moçambique: Inquérito demográfico e de saúde, 1997. Maryland, USA: Instituto Nacional de Estatística/ DHS Macro International Inc.
- Gavin, N., Merrick, N. & Davidson, B. (1996).** Efficacy of glucose-based oral rehydration therapy. *Pediatrics* 98, 45-51.
- Genton, B., Hii, J., al-Yaman, F., Paru, R., Beck, H., Ginny, M., Dagoro, H., Lewis, D. & Alpers, M. (1994).** The use of untreated bednets and malaria infection, morbidity and immunity. *Ann Trop Med Parasitol* 88, 263-270.
- Ghosh, S., SenGupta, P., Mondal, S., Banu, M., Gupta, D. & Sircar, B. (1997).** Risk behavioural practices of rural mothers as determinants of childhood diarrhoea. *J Com Dis* 29, 7-14.
- Gibbs, G. (2002).** *Qualitative data analysis: explorations with NVivo*. Buckingham/ Philadelphia: Open University Press.
- Gil, A., Lanata, C., Kleinau, E. & Penny, M. (2004).** Children's faeces disposal practices in developing countries and interventions to prevent diarrhoeal diseases: Instituto de Investigacion Nutricional (Peru).
- Gilman, R., Marquis, G., Ventura, G., Campos, M., Spiro, W. & Diaz, F. (1993).** Water cost and availability: key determinants of family hygiene in a Peruvian shantytown. *American Journal of Public Health* 83, 1554-1558.

- Gittelsohn, J., Shankar, A., West, K., Ram, R. & Gnyawali, T. (1997).** Estimating reactivity in direct observation studies of health behaviours. *Hum Organ* 56, 182-189.
- Glasser, B. & Strauss, A. (1967).** *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Chicago: Aldine Publishing Company.
- Goldman, N., Pebley, A. & Gragnolati, M. (2002).** Choices about treatment for ARI and diarrhoea in rural Guatemala. *Social Science & Medicine* 55, 1693-1712.
- Gorter, A., Sandiford, P., Pauw, J., Morales, P., Pèrez, R. & Alberts, H. (1998).** Hygiene behaviour in rural Nicaragua in relation to diarrhoea. *International Journal of Epidemiology* 27, 1090-1110.
- Govere, J., Durrheim, D., la Grange, K., Mabuza, A. & Booman, M. (2000).** Community knowledge and perceptions about malaria and practices influencing malaria control in Mpumalanga province, South Africa. *South African Medical Journal* 90, 611-616.
- Green, J. & Thorogood, N. (2004).** *Qualitative methods for health research*. London: Sage.
- Greenwood, B. (1999).** What can the residents of malaria endemic countries do to protect themselves against malaria? *Parasitologia* 41, 295-299.
- Greenwood, B. & Mutabingwa, T. (2002).** Malaria in 2002. *Nature* 415, 670-672.
- Guerrant, D., Moore, S., Lima, A., Patrick, P., J, S. & Guerrant, R. (1999).** Association of early childhood diarrhoea and cryptosporidiosis with impaired physical fitness and cognitive function four-seven years later in a poor urban community in Northeast Brazil. *American Journal of Tropical Medicine and Hygiene* 61, 707-713.
- Gunawardena, D., Wickremasinghe, A., Muthuwatta, L., Weerasingha, S., Rajakaruna, J., Senanayaka, T., Kotta, P., Attanayake, N., Carter, R. & Mendis, K. (1998).** Malaria risk factors in an endemic region of Sri Lanka, and the impact and cost implications of risk factor-based interventions. *Am J Trop Med Hyg* 58, 533-542.
- Guyatt, H., Ochila, S. & Snow, R. (2002).** Too poor to pay: charging for insecticide-treated bednets in highland Kenya. *Tropical Medicine & International Health* 7, 846-850.
- Gyapong, M., Gyapong, J., Amankwa, J., Asedem, J. & Sory, E. (1996).** Introducing insecticide impregnated bednets in an area of low bednet usage: an exploratory study in north-east Ghana. *Trop Med Int Health* 1, 328-333.
- Hagmann, R., Charlwood, J., Gil, V., Ferreira, C., do Rosario, V. & Smith, T. (2003).** Malaria and its possible control on the island of Principe. *Malaria Journal* 2.
- Hakim, A., Salway, S. & Miumtaz, Z. (2003).** Women's autonomy and uptake of contraception in Pakistan. *Asia Pacific Population Journal*, 63-81.

- Halvorson, S. (2004).** Women's management of the household health environment: responding to childhood diarrhoea in the Northern areas, Pakistan. *Health & Place* **10**, 43-58.
- Handa, S. (1996).** Expenditure behavior and children's welfare: an analysis of female headed households in Jamaica. *J Dev Econ* **50**, 165-187.
- Handwerker, W. (1994).** Short scales for family violence (exploitation) and affection (empowerment). *Cultural Anthropology Methods* **6**.
- Hanson, K., Kikumbih, N., Armstrong Schellenberg, J., Mponda, H., Nathan, R., Lake, S., Mills, A., Tanner, M. & Lengeler, C. (2003).** Cost-effectiveness of social marketing of insecticide-treated nets for malaria control in the United Republic of Tanzania. *Bull World Health Organ.* **81**, 269-276.
- Harkness, S. & Super, C. (1994).** The developmental niche: a theoretical framework for analyzing the household production of health. *Social Science & Medicine* **38**, 217-226.
- Hausmann Muela, S. (2000).** Community understanding of malaria, and treatment-seeking behaviour, in a holoendemic area of southeastern Tanzania. In *Philosophisch-Naturwissenschaftlichen Fakultät*. Basel: Universität Basel.
- Heatherton, T. & Polivy, J. (1991).** Development of a scale to measure self-esteem. *Journal of Personality and Social Psychology* **60**, 895-910.
- Henekens, C. & Buring, J. (1987).** *Epidemiology in Medicine*. Boston: Little, Brown & Company.
- Hennekens, C. & Buring, J. (1987).** *Epidemiology in Medicine*. Philadelphia: LW&W.
- Hesketh, T. & Zhu, W. (2004).** Effect of restricted freedom on health in China. *BMJ* **329**, 1427.
- Hill, K. (1993).** Life history theory and evolutionary anthropology. *Evolutionary Anthropology: Issues, News, and Reviews* **2**, 78-88.
- Hobcraft, J. (1993).** Women's education, child welfare and child survival: a review of the evidence. *Health Transition Review* **3**, 159-173.
- Hobcraft, J., McDonald, J. & Rutstein, S. (1985).** Demographic determinants of infant and early child mortality: a comparative analysis. *Population Studies* **39**, 363-385.
- Hoque, B., Ahmed, S. & Al Mahmud, A. (2002).** Handwashing Practices in Urban and Rural Areas of Bangladesh: Centre for Health and Population Research
<http://www.icddr.org/pub/publication.jsp?classificationID=1&pubID=2979>.

Hoque, B., Chakraborty, J., Chowdhury, J., Chowdhury, U., Ali, M., el Arifeen, S. & Sack, R. (1999). Effects of environmental factors on child survival in Bangladesh: a case control study. *Public Health* **113**, 57-64.

Hoque, B. A. & Islam, S. (1995). Post-defecation handwashing in Bangladesh: practice and efficiency perspectives. *Public Health* **109**, 15-24.

Hoque, B. A., Mahalanabis, D., Pelto, B. & Alam, N. (1995). Research methodology for developing efficient handwashing options: an example of Bangladesh. *Journal of Tropical Medicine and Hygiene* **98**, 469-475.

Hoque, B. A., Huttly, S., Aziz, K., Patwary, M. & Faechem, R. (1989). Tubewell water consumption and its determinants in a rural area of Bangladesh. *Journal of tropical Medicine and Hygiene* **92**, 197-202.

Howard, N., Chandramohan, D., Freeman, T., Shafi, A., Rafi, M., Enayatullah, S. & Rowland, M. (2003). Socio-economic factors associated with the purchasing of insecticide-treated nets in Afghanistan and their implications for social marketing. *Tropical Medicine & International Health* **8**, 1043-1050.

Howard, S. C., Omumbo, J., Nevill, C., Some, E. S., Donnelly, C. A. & Snow, R. W. (2000). Evidence for a mass community effect of insecticide-treated bednets on the incidence of malaria on the Kenyan coast. *Transactions of the Royal Society of Tropical Medicine and Hygiene* **94**, 357-360.

Huttly, S., Morris, S. & Pisani, V. (1997). Prevention of diarrhoea in young children in developing countries. *Bulletin of the World Health Organization* **75**, 163-174.

Huttly, S., Lanata, C., Gonzales, H., Aguilar, I., Fukumoto, M., Verastegui, H. & Black, R. (1994). Observations on handwashing and defecation practices in a shanty town of Lima, Peru. *J Diarrhoeal Dis Res* **12**, 14-18.

IIASA (2001). Botswana's future, Namibia's future, Mozambique's future: Modelling population and sustainable development challenges in the era of HIV/AIDS: International Institute for Applied Systems Analysis (IIASA).

INE (1996). Inquérito Demográfico e de Saúde - Moçambique. Maputo: Instituto Nacional de Estatística.

INE (2001). Questionários de indicadores básicos de bem-estar (QUIBB). Maputo: Moçambique: Instituto Nacional de Estatística.

INE (2004). Actualização das projecções da população total e por área de residência. Maputo: Moçambique: Instituto Nacional de Estatística.

INE, MISAU & ORC/Macro (2005). Moçambique: inquérito demográfico e de saúde 2003. Maputo, Moçambique: Instituto Nacional de Estatística
Ministério da Saúde
ORC/Macro.

- INSTRAW (1991).** Women, Water and Sanitation. In *"Women and the environment: a reader crisis and development in the third world"*, pp. 119-132. Edited by S. Sontheimer. London: Earthscan Publications Limited.
- Jenkins, M. (1999).** Sanitation promotion in developing countries: why the latrines of Benin are few and far between, pp. 433. California: University of California Davis.
- Jenkins, M. & Curtis, V. (2005).** Achieving the 'good life': why some people want latrines in rural Benin. *Social Science & Medicine* **61**, 2446-2459.
- Jensen, P., Jayasinghe, G., Hoek, W., Cairncross, S. & Dasgaard, A. (2004).** Is there an association between bacteriological drinking water quality and childhood diarrhoea in developing countries? *Tropical Medicine & International Health* **9**, 1210-1215.
- Joshi, A. (1994).** Maternal schooling and child health: preliminary analysis of the intervening mechanisms in rural Nepal. *Health Transition Review* **4**, 1-28.
- Junod, H. (1996).** *Usos e costumes dos Bantu: Vida social*. Maputo: Arquivo Histórico de Moçambique.
- Jurg, A., Tomas, T., Dgedge, A. & Green, E. (1992).** Crenças e práticas tradicionais relativas à diarreia infantil e às doenças diarreicas infantis e as DTS/SIDA na provincia de manica, no centro de Moçambique. Maputo: MISAU.
- Kabir, M. & Amin, R. (1993).** Factors influencing child mortality in Bangladesh and their implications for the National Health Programme. *Asia-Pacific Population Journal* **8**, 31-46.
- Kahigwa, E., Schellenberg, D., Sanz, S., Aponte, J. J., Wigayi, J., Mshinda, H., Alonso, P. L. & Menendez, C. (2002).** Risk factors for the presentation to hospital with severe anaemia in Tanzanian children: a case-control study. *Tropical Medicine & International Health* **7**, 823-830.
- Kaltenthaler, E. C. & Drasar, B. (1996a).** The study of hygiene behaviour in Botswana: a combination of qualitative and quantitative methods. *Tropical Medicine & International Health* **1**, 690-698.
- Kaltenthaler, E. C. & Drasar, B. (1996b).** Understanding of hygiene behaviour and diarrhoea in two villages in Botswana. *J Diarrhoeal Dis Res* **14**, 75-80.
- Katcha, S. & Watts, S. (2002).** *Gender, behaviour, and health: Schistosomiasis transmission and control in rural Egypt*: The American University in Cairo Press.
- Kikumbih, N., Hanson, K., Mills, A., Mponda, H. & Schellenberg, J. (2005).** The economics of social marketing: the case of mosquito nets in Tanzania. *Social Science & Medicine* **60**, 369-381.
- Kirkwood, B. & Sterne, J. (2003).** *Essencial Medical Statistics*, 2 edn: Blackwell Science.
- Knell, A. (1991).** *Malaria*: The Wellcome Trust, Oxford University Press.

- Kolstrup, N., McMahon, J., Magayuka, S., Mosha, F., Bushrod, F. & Bryan, J. (1981).** Control measures against Bancroftian filariasis in coastal villages in Tanzania. *Ann Trop Med Parasitol* **75**, 433-451.
- Korenromp, E., Miller, J., Cibulskis, R., Cham, M., Alnwick, D. & Dye, C. (2003).** Monitoring mosquito net coverage for malaria control in Africa: possession vs. use by children under 5 years. *Tropical Medicine & International Health* **8**, 693-703.
- Kosek, M., Bern, C. & Guerrant, R. (2003).** The global burden of diarrhoeal disease, as estimated from studies published between 1992 and 2000. *Bulletin of the World Health Organization* **81**, 197-204.
- KPMG (2004).** Business Confidence Index in Mozambique. Maputo.
- Lanata, C., Huttly, S. & Yeager, B. (1998).** Diarrhea: whose feces matter? Reflections from studies in a Peruvian shanty town. *Pediatr Infect Dis J* **17**, 7-9.
- Lawrance, C. & Croft, A. (2004).** Do mosquito coils prevent malaria? A systematic review of trials. *J Travel Med* **11**, 92-96.
- Lengeler, C. (2004).** Insecticide-treated bednets and curtains for preventing malaria. *The Cochrane Database of Systematic Reviews*.
- Levine, R., Khan, M., D'Souza, S. & Nalin, D. (1976).** Failure of sanitary wells to protect against cholera and other diarrhoeas in Bangladesh. *Lancet* **2**, 86-89.
- Lindelow, M. (2006).** Sometimes more equal than others: how health inequalities depend on the choice of welfare indicator. *Health Economics* **15**, 263-279.
- Lindenbaum, S., Chakraborty, M. & Elias, M. (1989).** The influence of maternal education on infant and child mortality in Bangladesh. In *Selected readings in the cultural, social and behavioural determinants of health*. Edited by S. G. Caldwell J. Canberra.
- Lines, J. D., Baolin, L. U., Renz, A. & Curtis, C. F. (1989).** Natural and synthetic repellents: the need for further assessment of the effectiveness of traditional repellents. In *Appropriate technology in vector control*. Edited by C. F. Curtis: CRC Press.
- Luby, S., Agboatwalla, M., Feikin, D., Painter, J., Billhimer, W., Altaf, A. & Hoekstra, R. (2005).** Effect of handwashing on child health: a randomised controlled trial. *Lancet* **366**, 225-233.
- Lukwa, N., Nyazema, N., Curtis, C. F., Mwaiko, G. & Chandiwana, S. (1999).** People's perceptions about malaria transmission and control using mosquito repellent plants in a locality in Zimbabwe. *Central African Journal of Medicine* **45**, 64-68.
- Lynch, W., Kaplan, G. & Salonen, J. (1997).** Why do poor people behave poorly? variation in adult health behaviours and psychosocial characteristics by stages of the socioeconomic lifecourse. *Social Science & Medicine* **44**, 809-819.

- Mabaso, M., Sharp, B. & Lengeler, C. (2004).** Historical review of malarial control in southern Africa with emphasis on the use of indoor residual house-spraying. *Tropical Medicine & International Health* **9**, 846-856.
- Macassa, G., Ghilagaber, G., Bernhardt, E., Diderichsen, F. & Burstrom, B. (2003).** Inequalities in child mortality in Mozambique: differentials by parental socio-economic position. *Social Science & Medicine* **57**, 2255-2264.
- MacCormack, C. (1984).** Human ecology and behaviour in malaria control in tropical Africa. *Bulletin of the World Health Organization* **62**, 81-87.
- MacCormack, C. & Snow, R. (1986).** Gambian cultural preferences in the use of insecticide-impregnated bed nets. *Journal of Tropical Medicine and Hygiene* **89**, 295-302.
- Macheso, A., Nyasulu, Y., Ziba, C., Nwanyanwu, O., Steketee, L., Ettling, M., Schultz, L. & Chitsulo, L. (1994).** Malaria knowledge, attitudes and practices in Malawi: policy implications for the National Malaria Control Program. *Trop Med Parasitol* **45**, 80-81.
- Macinko, J., Shi, L. & Starfield, B. (2004).** Wage inequality, the health system, and infant mortality in wealthy industrialised countries, 1970-1996. *Social Science & Medicine* **58**, 279-292.
- Macintyre, K., Keating, J., Sosler, S., Kibe, L., Mbogo, C., Githeko, A. & Beier, J. (2002).** Examining the determinants of mosquito-avoidance practices in two Kenyan cities. *Malaria Journal* **1**.
- Macleod, J. & Smith, D. (2003).** Psychosocial factors and public health: a suitable case for treatment? *J Epidemiol Community Health* **57**, 565-570.
- Manun'Ebo, M., Cousens, S., Haggerty, P., Kalengaie, M., Ashworth, A. & Kirkwood, B. (1997).** Measuring hygiene practices: a comparison of questionnaires with direct observations in rural Zaire. *Trop Med Int Health* **2**, 1015-1021.
- Marques, P. X., Saùte, F., Pinto, V., Cardoso, S., Pinto, J., Alonso, P. L., Rosàrio, V. D. & Arez, A. P. (2005).** Plasmodium species mixed infections in two areas of Manhiça District, Mozambique. *Int J Biol Sci* **1**, 96-102.
- Marshall, J. (1990).** Structural Adjustment and Social Policy in Mozambique. *Review of African Political Economy* **17**, 28-43.
- Martin, P. & Bateson, P. (1986).** *Measuring Behaviour: and introductory guide*. Cambridge: Cambridge University Press.
- Maslow, A. (1954).** *Motivation and Personality*. New York: Harper & Row.
- McLennan, J. (2000).** Prevention of diarrhoea in a poor district of Santo Domingo, Dominican Republic: practices, knowledge and barriers. *J Health Popul Nutr* **18**, 15-22.

- Meekers, D. (1994).** Sexual initiation and premarital childbearing in sub-Saharan Africa. *Population Studies* **48**, 47-64.
- Mendis, C., Jacobsen, J., Gamage-Mendis, A., Bule, E., Dgedge, M., Thompson, R., Cuamba, N., Barreto, J., Begtrup, K., Sinden, R. & Hogg, B. (2000).** Anopheles arabiensis and An. funestus are equally important vectors of malaria in Matola coastal suburb of Maputo, southern Mozambique. *Med Vet Entomol* **14**, 171-180.
- Michel, A., Ingrassi, M., Schemerhorn, B., Kern, M., Le Goff, G., Coetzee, M., Elissa, N., Fontenille, D., Vulule, J., Lehmann, T., Sagnon, N., Costantini, C. & Besansky, N. (2005).** Rangewide population genetic structure of the African malaria vector Anopheles funestus. *Molecular Ecology* **14**, 4235-4248.
- Miguel, E. & Kremer, M. (2003).** Networks, social learning and technology adoption: the case of deworming drugs in Kenya:
<http://www.povertyactionlab.com/papers/Networks%20Social%20Learning%20Technology%20Adoption.doc>.
- Milroy, C., Borja, P., Barros, F. & Barreto, M. (2001).** Evaluating sanitary quality and classifying urban sectors according to environmental conditions. *Environment & Urbanization* **13**, 235-255.
- Minja, H., Shellenberg, J., Mukasa, O., Nathan, R., Abdulla, S., Mponda, H., Tanner, M., Lengeler, C. & Obrist, B. (2001).** Introducing insecticide-treated nets in the Kilombero Valley, Tanzania: the relevance of local knowledge and practice for an Information, Education and Communication (IEC) campaign. *Tropical Medicine & International Health* **6**, 614-623.
- MISAU (2005).** Programa Nacional de Controlo da Malária (PNCM):
<http://www.misau.gov.mz/pt/layout/set/print/destaques/malaria>.
- Molyneux, C. S., Murira, G., Masha, J. & Snow, R. W. (2002).** Intra-household relationships and treatment decision-making for childhood illness: a Kenyan case study. *Journal of Biosocial Science* **34**, 109-131.
- Monash, R., Reinisch, A., Steketee, R., Korenromp, E., Alnwick, D. & Bergevin, Y. (2004).** Child coverage with mosquito nets and malaria treatment from population-based surveys in African countries: A baseline for monitoring progress in roll back malaria. *Am J Trop Med Hyg* **71**, 232-238.
- Mosley, W. & Chen, L. (1984).** An analytical framework for the study of child survival in developing countries. *Population and Development Review* **10**, 25-45.
- MPF (1996).** Moçambique - perfil da pobreza rural. Maputo: Ministério do Plano e Finanças - Unidade do Alívio a Pobreza.
- MPF & UNICEF (1996).** Multiple indicator cluster survey Mozambique -1995, pp. 9. Maputo: Government of Mozambique and UNICEF.

- Mugisha, F. & Arinaitwe, J. (2003).** Sleeping arrangements and mosquito net use among under-fives: results from the Uganda Demographic and Health Survey. *Malaria Journal* 2.
- Munguambe, K. (2001).** Emic and Etic perspectives of Household Environmental Health. In *Infectious and Tropical Diseases*, pp. 80. London: London School of Hygiene & Tropical Diseases.
- Mushi, A., Schellenberg, J., Mponda, H. & Lengeler, C. (2003).** Targeted subsidy for malaria control with treated nets using a discount voucher system in Tanzania. *Health Policy & Planning* 18, 163-171.
- Nettleton, S. & Gustafsson, U. (2002).** The Sociology of Health and Illness Reader. Cambridge: Polity Press.
- Nuwaha, F. (2001).** Factors influencing the use of bed nets in Mbarara Municipality of Uganda. *Am J Trop Med Hyg* 65, 877-882.
- Okrah, J., Traorè, C., Palè, A., Sommerfeld, J. & Muller, O. (2002).** Community factors associated with malaria prevention by mosquito nets: an exploratory study in rural Burkina Faso. *Trop Med Int Health* 7, 249-248.
- Omotade, O., Kayode, C., Adeyemo, A. & Oladimeji, O. (1995).** Observation of handwashing practices of mothers and environmental conditions in Ona-Ara local government area of Oyo State, Nigeria. *J Diarrhoeal Dis Res* 13, 224 - 228.
- Panter-Brick, C. (1992).** Women's working behaviour and maternal-child health in rural Nepal. In *Physical Activity and Health*, pp. 190-206. Edited by N. Norgan. Cambridge: Cambridge University Press.
- Parashar, U., Bresee, J. & Glass, R. I. (2003).** The global burden of diarrhoeal disease in children. *Bulletin of the World Health Organization* 81, 236.
- Pates, H. & Curtis, C. (2005).** Mosquito behavior and vector control. *Annu Rev Entomol* 50.
- Pfeiffer, J., Gloyd, S. & Li, L. (2001).** Intrahousehold resource allocation and child growth in Mozambique: an ethnographic case-control study. *Social Science & Medicine*, 83-97.
- Pitts, M., McMaster, J., Hartmann, T. & Mausezahl, D. (1996).** Lay beliefs about diarrhoeal diseases: their role in health education in a developing country. *Social Science & Medicine* 43, 1223-1228.
- Port, G. & Boreham, P. (1982).** The effect of bed nets on feeding by *Anopheles gambiae* Giles (Diptera: Culicidae). *Bulletin of Entomological Research* 72, 483-488.
- Prüss, A. & Mariotti, S. (2000).** Preventing trachoma through environmental health sanitation: a review of the evidence base. *Bull World Health Organ.* 78, 258-266.

- Prüss, A., Kay, D., Fewtrell, L. & Bartram, J. (2002).** Estimating the burden of diseases from water, sanitation, and hygiene at a global level. *Environmental Health Perspectives* **110**, 537- 542.
- Prüss-Ustün, A., Mathers, C., Corvalán, C. & Woodward, A. (2003).** *Introduction and methods: assessing the environmental burden of disease at national and local levels*. Geneva: WHO.
- Rashed, S., Johnson, J., Dongier, P., Moreau, R., Lee, C., Crepeau, R., Lambert, J., Jefremovas, V. & Schaffer, C. (1999).** Determinants of the permethrin impregnated bednets (PIB) in the Republic of Benin: the role of women in the acquisition and utilization of PIBs. *Social Science & Medicine* **49**, 993-1005.
- Rauyajin, O., Pasandhanatorn, V., Rauyajin, V., Na-nakorn, S., Ngarmyithayapong, J. & Varothai, C. (1994).** Mothers' hygiene behaviours and their determinants in Suphanburi, Thailand. *J Diarrhoeal Dis Res* **12**, 25-34.
- Roll Back Malaria (2000).** In *The African Summit on Roll Back Malaria*. Abuja: World Health Organisation.
- Rosenfield, P. (1985).** The contribution of social and political factors to good health. In *Good health at low cost*, pp. 173-185. Edited by W. J. Halstead S, Warren K. New York: Rockefeller Foundation.
- Rotter, J. (1966).** Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs* **33**, 300-303.
- Røysamb, E., Rise, J. & Kraft, P. (1997).** On the structure and dimensionality of health-related behaviour in adolescents. *Psychology and Health* **12**, 437-452.
- Ruel, M. & Arimond, M. (2002).** Spot-check observational method for assessing hygiene practices: Review of experience and implications for programmes. *Journal of Health Population and Nutrition* **20**, 65-76.
- Rummel, R. (1970).** *Applied Factor Analysis*. Evanston: Northwestern University Press.
- Russell, S. (1996).** Ability to Pay for Health Care: Concepts and Evidence. *Health Policy & Planning* **11**, 219-237.
- Russell, S. (2004).** The economic burden of illness for households in developing countries: a review of studies focusing on malaria, tuberculosis, and human immunodeficiency virus/acquired immunodeficiency syndrome. *American Journal of Tropical Medicine and Hygiene* **71**, 147-155.
- Sallee, J. (2001).** The effect of improved female status on child health: empirical evidence from India. St. Paul, Minnesota: Macalester College.

- Samuelsen, H., Toè, L., Baldet, T. & Skovmand, O. (2004).** Prevention of mosquito nuisance among urban populations in Burkina Faso. *Social Science & Medicine* **59**, 2361-2371.
- Sandiford, P., Cassel, J., Sanchez, G. & Coldham, C. (1997).** Does intelligence account for the link between maternal literacy and child survival? *Social Science & Medicine* **45**, 1231-1239.
- Satterthwaite, D., Hart, R., Levy, C., Mitlin, D., Ross, D., Smit, J. & Stephens, C. (1996).** *The environment for children: Understanding and acting on the environmental hazards that threaten children and their parents.* London: Earthscan.
- Saùte, F., Aponte, J. J., Almeda, J., Ascaso, C., Vaz, N., Dgedge, M. & Alonso, P. L. (2003).** Malaria in southern Mozambique: incidence of clinical malaria in children living in a rural community in Manhiça district. *Transactions of the Royal Society of Tropical Medicine and Hygiene* **97**, 655-660.
- Schellenberg, J., Abdulla, S., Minja, H., Nathan, R., Mukasa, O., Marchant, T., Mponda, H., Kikumbih, N., Lyimo, E., Manchester, T., Tanner, M. & Lengeler, C. (1999).** KINET: a social marketing programme of treated nets and net treatment for malaria control in Tanzania, with evaluation of child health and long-term survival. *Trans R Soc Trop Med Hyg* **93**, 225-231.
- Schellenberg, J., Abdulla, S., Nathan, R., Mukasa, O., Marchant, T., Kikumbih, N., Mushi, A., Mponda, H., Minja, H., Mshinda, H., Tanner, M. & Lengeler, C. (2001).** Effect of large-scale social marketing of insecticide-treated nets on child survival in rural Tanzania. *Lancet* **357**, 1241-1247.
- Schofield, C. J., Briceno-Lèon, R., Kolstrup, N., Webb, D. J. T. & White, G. B. (1989).** The role of house design in limiting vector-borne disease. In *Appropriate technology in vector control*, pp. 187-212. Edited by C. F. Curtis: CRC Press.
- Schwalbach, J. & de la Maza, M. (1985).** A Malária em Moçambique [1937-1973]. Maputo: Ministério da Saúde, Instituto Nacional de Saúde.
- Scott, B., Curtis, V. & Rabie, T. (2003).** Protecting children from diarrhoea and acute respiratory infections: The role of hand washing promotion in water and sanitation programmes. *Regional Health Forum* **7**, 42-47.
- Scott, B., Curtis, V., Rabie, T. & Gabra-Aidoo, N. (2002).** What Motivates Handwashing in Ghana? A Re-analysis of the Results of the Formative Research.: Research International and the PPPHW team.
- Sen, A. (1999).** *Development as Freedom.* Oxford University Press.
- Sitoe, B. (1996).** *Dicionário Changana-Português.* Maputo: INDE.
- Smith, G., Hart, C., Hole, D., Mackimon, P., Gills, C., Blane, D. & Hawthorne, V. (1998).** Education and occupational social class: which is the most important indicator of mortality risk? *Journal of Epidemiology and Community Health* **52**, 153-160.

Smith, K., Samet, J., Romieu, I. & Bruce, N. (2000). Indoor air pollution in developing countries and acute lower respiratory infections in children. *Thorax* **55**, 518-532.

Snow, R., Trape, J. & Marsh, K. (2001). The past, present and future of childhood malaria mortality in Africa. *Trends in Parasitology* **17**, 593-597.

Snow, R., Rowan, K., Lindsay, S. & Greenwood, B. (1988). A trial of bed nets (mosquito nets) as a malaria control strategy in a rural area of The Gambia, West Africa. *Transactions of the Royal Society of Tropical Medicine and Hygiene* **82**, 212-215.

Snow, R., Craig, M., Deichman, V. & Marsh, K. (1999). Estimating mortality, morbidity and disability due to malaria among Africa's non-pregnant population. *Bulletin of the World Health Organization* **77**, 624-640.

Snow, R., Bradley, A., Hayes, R., Byass, P. & Greenwood, B. (1987). Does woodsmoke protect against malaria? *Ann. Trop. Med. Parasitol.* **81**, 449-451.

Snyder, J. D. & Merson, M. H. (1982). The magnitude of the global problem of acute diarrhoeal disease: a review of the active surveillance data. *Bulletin of the World Health Organization* **60**, 605-613.

SPSS Inc. (2003). SPSS[®] 12.0.1. Chicago.

Stanton, B., Clemens, J., Aziz, K. & Rahman, M. (1987). Twenty-four hour recall, knowledge-attitude-practice questionnaires, and direct observations of sanitary practices: a comparative study. *Bulletin of the World Health Organization* **65**, 217-222.

StataCorp (1984-2006). STATA[™] 8. Texas.

Strina, A., Cairncross, S., Barreto, M., Larrea, C. & Prado, M. (2003). Child diarrhoea and observed hygiene behavior in Salvador, Brazil. *American Journal of Epidemiology*.

Sykes, M., Tolhurst, R. & Bates, I. (2003). Vulnerability to malaria in Ghana: health policy and access. In *Satellite workshop to the global Forum for Health Research, forum 7 - "Applying approaches to vulnerability in communicable diseases: policy focused research on access to care"*. Geneva.

Tabachnick, B. & Fidell, L. (1996). *Using Multivariate Statistics*, 3 edn: Harper Collins.

The Netmark Project (2001). Baseline survey on insecticide treated materials (ITMs) in Mozambique. Mozambique.

Thomson, M., Connor, S., Bennett, S., D'Alessandro, U., Milligan, P., Aikins, M., Langerock, P., Jawara, M. & Greenwood, B. (1996). Geographical perspectives on bednet use and malaria transmission in the Gambia, West Africa. *Social Science & Medicine* **43**, 101-112.

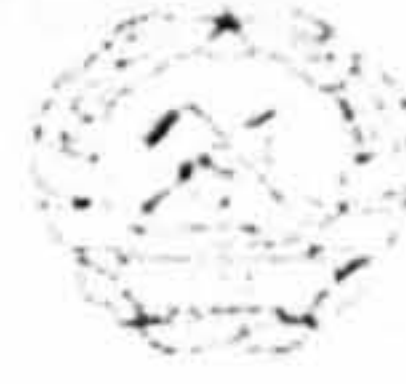
- Tibballs, J. (1996).** Teaching hospital medical staff to handwash. *Medical Journal of Australia* 164, 395-398.
- Tobar, F. & Yalour, M. (2002).** *Como fazer teses em saúde pública: conselhos e idéias para formular projetos e redigir teses e informes de pesquisas.* Rio de Janeiro: Fiocruz.
- Trape, J., Pison, G., Spiegel, A., Enel, C. & Rogier, C. (2002).** Combating malaria in Africa. *Trends Parasitol* 18, 224-230.
- Tumwine, J., Thompson, J., Katui-Katua, M., Mujwahuzi, M., Johnstone, N. & Porras, I. (2003).** Sanitation and hygiene in urban and rural households in East Africa. *International Journal of Environmental Health Research* 13, 107-115.
- Twebaze, D. (2001).** A Literature Review of Care-Seeing Practices for Major Childhood Illnesses in Uganda. Arlington, Virginia: USAID.
- UN (2000).** Mozambique Common Country Assessment (CCA). Maputo: United Nations System in Mozambique.
- UNDP (1997).** Human development report. Lisbon: UNDP.
- UNDP (2002).** Mozambique national human development report 2001: Gender, women, and human development - an agenda for the future. Maputo.
- UNEP, U., WHO (2002).** *Children in the New Millennium: Environmental Impact on Health.*
- UNICEF (1989).** State of the World's Children 1989. New York: Oxford University Press.
- United Nations (1985).** *Socio-economic differentials in child mortality in developing countries.* New York: UN Department of Social and Economic Affairs.
- Van Bortel, V., Barutwanayo, M., Delacollette, C. & Cosemans, M. (1996).** Motivation à l'acquisition et à l'utilisation des moustiquaires imprégnées dans une zone à paludisme stable au Burundi. *Tropical Medicine & International Health* 1, 71-80.
- Victora, C., Bryce, J., Fontaine, O. & Monash, R. (2000).** Reducing deaths from diarrhoea through oral rehydration therapy. *Bulletin of the World Health Organization* 78, 1246-1255.
- Victora, C., Huttly, S., Barros, F., Lombardi, C. & Vaughan, J. (1992).** Maternal education in relation to early and late child health outcomes: findings from a Brazilian cohort study. *Social Science & Medicine* 34, 899-905.
- Vundule, C. & Mharakurwa, S. (1996).** Knowledge, practices, and perceptions about malaria in rural communities of Zimbabwe: relevance to malaria control. *Bulletin of the World Health Organization* 74, 55-60.

- Wagner, E. & Lanoix, J. (1958).** Excreta Disposal for Rural Areas and Small Communities. *WHO Monograph series* **39**.
- Ware, H. (1984).** Effects of Maternal Education, Women's Roles and Child Care on Child Mortality in Child survival; Strategies for Research. *Population and Development Review* **10**, 191-214.
- Warwick, H. & Doig, A. (2004).** Smoke - the killer in the kitchen: Indoor Air Pollution in Developing Countries. London: ITDG.
- Waterkyn, J. & Cairncross, S. (2005).** Creating demand for sanitation and hygiene through community health clubs: a cost-effective intervention in two districts in Zimbabwe. *Social Science & Medicine* **61**, 1958-1970.
- Webster, J., Lines, J., Bruce, J., Schellenberg, J. & Hanson, K. (2005).** Which delivery systems reach the poor? A review of equity of coverage of ever-treated nets, never-treated nets, and immunisation to reduce child mortality in Africa. *Lancet Infectious Diseases* **5**, 709-717.
- Westaway, M. & Viljoen, E. (2000).** Health and hygiene knowledge, attitudes and behaviour. *Health & Place* **6**, 25-32.
- White, G., Bradley, D. & White, A. (1972).** *Drawers of Water: Domestic Water Use in East Africa*. Chicago, USA: University of Chicago Press.
- WHO (1993).** The Management and Prevention of Diarrhoea: Practical Guidelines., pp. 55. Geneva: World Health Organisation.
- WHO (2001).** World Health Report - Mental Health: New understanding, new people.
- WHO (2005).** World Health Report - Make every mother and child count.
- WHO/UNICEF (2003).** The Africa malaria report 2003.
- Wils, A., Gaspar, M. d. C., Hellmuth, M. E., Maimuna Ibraimo, Prommer, I. & Sebastião, E. (2001).** Mozambique's future. Modeling population and sustainable development challenges: International Institute for Applied Systems Analysis.
- Wood, S., Sawyer, R. & Simpson-Herbert, M. (1998).** *PHAST Step-by-step guide: A participatory approach for the control of diarrhoeal disease*. Geneva: WHO.
- World Bank (1993).** World Development Report 1993: Investing in health, pp. 37-51.
- World Bank (2001).** World development report 2000/2001: Attacking poverty, pp. 117-131: World Bank.
- Yeager, B., Huttly, S., Bartolini, R., Rojas, M. & Lanata, C. (1999).** Defecation practices of young children in a Peruvian shanty town. *Social Science & Medicine* **49**, 531- 541.

Ziba, C., Slutsker, L., Chitsulo, L. & Stekete, R. (1994). Use of malaria prevention measures in Malawian households. *Trop Med Parasitol* 45, 70-73.

Zimicki, S. (1997). Promotion in Sub-Saharan Africa (Part 2). In *NET GAIN: A New Method for Preventing Malaria Deaths*, pp. 260. Edited by C. Lengeler, J. Cattani & D. de Savigny: IDRC/WHO.

Appendix



REPÚBLICA DE MOÇAMBIQUE

MINISTÉRIO DA SAÚDE
COMITÉ NACIONAL DE BIOÉTICA PARA A SAÚDE

Ex^{ma} Senhora

Dra. Khátia Munguambe
Maputo

Ref: 022/CNBS/02

Data: 27 de Setembro de 2002

Assunto: Aprovação do protocolo sobre factores que influenciam à saúde ambiental doméstica.

Reunida no dia 26 de Setembro de 2002 a Comité Nacional de Bioética para a Saúde (CNBS) analisou o projecto com o seguinte título " **Factores que influenciam a natureza, frequência e variações de práticas relativas à saúde ambiental doméstica numa comunidade do Sul de Moçambique.**"

Sobre ele chegou-se às seguintes considerações e conclusões:

"Não existe nenhum inconveniente de ordem ética que impeça a realização do estudo. Contudo, a parte metodológica poderá ser melhorada para que os resultados obtidos possam ser melhor mensuráveis e mais fiáveis".

Sem mais assunto, os nossos cumprimentos.

O Presidente

Dr. João Manuel de Carvalho Fumane

ENDEREÇO
MINISTÉRIO DA SAÚDE
C. POSTAL 264
Av. Eduardo Mondlane/Salvador Alende
MAPUTO - MOÇAMBIQUE

Telefones: 41713114
306621
306613

Telex: 411007

Formulário de Aprovação de Bioética

LONDON SCHOOL OF HYGIENE
& TROPICAL MEDICINE

ETHICS COMMITTEE

APPROVAL FORM

Application number: 905



Name of Principal Investigator **Khatia Rebeca Munguambe**

Department **Infectious & Tropical Diseases**

Head of Department **Professor Hazel Dockrell**

Title **Household environmental health practices in rural Mozambique.**

Approval of this study is granted by the Committee.

Chair T. W. Meade
Professor Tom Meade

Date 27.11.02

Approval is dependent on local ethical approval having been received.

Any subsequent changes to the consent form must be re-submitted to the Committee.

LONDON SCHOOL OF HYGIENE & TROPICAL MEDICINE
CENTRO DE INVESTIGAÇÃO EM SAÚDE DE MANHIÇA

Estudo sobre factores que influenciam as práticas relacionadas á saúde ambiental doméstica numa comunidade rural da Manhiça

Observações e entrevistas a membros dos agregados familiares

Mavonela ni swivitso aka vahanhi vale mintine - xipfumelelano

Vito la papayi/mamana/muwundli wa tsongwana _____

A Xikoluva xa Higiene (kulhayiseka kunene) ni Djahu xa Tropical a Tikweni la Londres. Xi endla a djondzo hiku tirhisana ni tsinza yata usentchi hita utome aka Manhiça (CISM). A Djondzo leyi yine kongometo hi tlelo linwana waku kola mahungu mayelano ni utive la matirhisela ya xitsungu aku tivhikelene ka mavabji lawa ma taleke ugopfu, nama veka swilhamaliso aka vatsongwana vaku sukela ku psaliwene kuya fika ntlanu wa malembe, hi tlelo linwana kulava ku tiviwa ku imp sine leswe vangelaka kuva ku lhawuliwa a matirhisela lawa niku imani lweyi a lhayaku swona.

Hi swalisima ku endliwa ka djondzo ya muxaka lowo a tikwene la hina, leswaku manungo lawa ma lavekaka mata vumba swinwe aku endlene ka makungu yaku fambisa a utome la xitsungu. Akamakungu lawa loko kunga kumeke a xitsungu hiku labjala a mangata ya malhweni, hikuva a varhangele va vakungu lawa hi makhambe manhinge a vative a mavonela ya vahanha va mughanga mayelano ni mavabji lawa angawona makarhataku ngopfu, nakona atativi leswi ava hanhi va nhimissa a swikarhatu swa utomi lavona. Hi xifananisso, a makungu manwana manga tsundzuxa a matsamela tiva a matirhisela ya ntumbuluku mayelano niku tivhikela sinwe djahene ka mavabji.

A mihandjo ya djondzo leyi yinga lhengela aku pumbene kaku kwatlelisana aka vadhokodela kumbe va enfermeiro sinwe ni timbhabji. Hikuva aka xitsungu kuni mayendlela manwana yaku tlambuxela a mavabji, kambe vadhokodela ava switive.

Ntsengo unhigi wamavabji ya ntolovelo aka vatsongwana, kufana ni kuvuyelela, a dzedzedze sinwe ni mavabji yaku hefemula manga vhikeliwa a kaya, hicolanu i swalisima kuva a djondzo leyi yi endliwa hiku xiya-xiya lomu uni mintine.

A hinavela kuva wena u nhika lisima a khambi leli laku kumeka ka munti wa wena ka djondzo leyi.

Aku lhawuliwa aka ni minte ku endliwe hiku kotlanisa. Nakona. A hi minte ku hinkwayu leyi lhawuliwike hika khambe laku sungula kuta kumeka 25 wa miminte, aka khambe la umbirhi atave ntsengo wa 400 wa miminte.

Kukota hikuma a minhlamulo ya lisima aka swivi tiso swa djondzo leyi, kuta endliwa swihlaya swa mintirhu xa xikaya a mintine leyi hlawuliweke sinwe ni swivitiso mayelano ni leswi vahanhi va minte vaswimbitso mayelano ni leswi vahanhi va minte vaswitivaka aku tivhikela mavabji. A hingata susa xikombiso naxinwe xa ngati.

A ntlangano unawana ni unwana uta heta xipimo xa minkama mitsongo ni mixo kumbe ni nhlikani. Nakona a hinavela ku endla aku pfluxela ka muxaka lowo makhambe manharhu (masiku ya 1, 3 na 5) akufambene ka mintirho leyo a swingata laveka kuva otsamela kule ni leswi swinta endluva. Hicolanu hita tsama a khonene na hi endla a ntirho la hina, leswaku unga hingeletive ka mintirho ya wena, ntsena hita swi veka a maphephene leswi swinga swa lisima swingata voniwa.

Loko ku hundzile vhiki linwe a nzaku ka ntirho wa maghanu ahi navela kuva hi tlela hitava ni mabulo mayelano ni swilo leswe swingatava swi voniwile. A mabulo lawa mata heta a nkama linwe, akufambene ka mabulo lawa kuta tsaliwa leswi ungata swi vula.

Aku kumeka ka dionzo leyi a hixikhomela, hileswaku akuna munhu lweyi a sinzisikwaka kuva akumeka kona.

Hambi lava vangata tihlaya kuva vakukuka ka djondzo leyi vanga switsika kama wihi na wihi liko va swilava.

Akangatava ni swikarhato hikola ka leswo (avangata hakela nandzu na unwe nakona avangata khatisiwa).

Amahungo hinkwalo lawa hingatamukuma matavekiwa xi hundleni, nakunga tiviwe lweyi ama lhayeke, hileswaku a vito lawena alingata kumeka a ntsungwine hambe ka phepha

Appendix 3: Information sheet for interviews and observations (Changana version)

linwana ni linwana. A matsalwa lawa hingata makuma swinwe ni mavito, swita tirhisiwa nstna aku lulami seneka djonzo.

Ungava ni xitiviso lexi unga navela ku xi endla mayelano leswi higa heta ku kuilamuxela?
Wa pfumela ku kumeka ka djondzo?

LONDON SCHOOL OF HYGIENE & TROPICAL MEDICINE
CENTRO DE INVESTIGAÇÃO EM SAÚDE DE MANHIÇA

Estudo sobre factores que influenciam as práticas relacionadas com a saúde ambiental doméstica numa comunidade rural da Manhiça

Discussões em grupos focais

Kudhokodhoko kisana hi mintlawwa - xipfumelelano

A xikoluva xa Higiene (kulhayiseka kunene) ni djahu xa Tropical a tikweni la Londres. Xi endla a djondzo hiku tirhisana ni tsinza yata usentchi hita utome aka Manhiça (CISM).

A Djondzo leyi yine konometo hi tlelo linwana waku kola manhungu mayelano ni utive la matirhisela ya xitsungu aku tivhikelene ka mavabji lawa ma taleke ugopfu, nama veka swilhamaliso aka vatsongwana vaku sukela ku psaliwene kuya fika ntlanu wa malembe, hi tlelo linwana kulava ku tiviwa ku impine leswe vangelaka kuva ku lhawuliwa a matirhisela lawa niku imani lweyi a lhayaku swona.

Hi swalisima ku endliwa ka djondzo ya muxaka lowo a tikwene la hina, leswaku manungo lawa ma lavekaka mata vumba swinwe aku endlene ka makungu yaku fambisa a utome la xitsungu. Akamakungu lawa loko kunga kumeke a xitsungu hiku labjala a mangata ya malhwenni, hikuva a varhangele va vakungu lawa hi makhambe manhinge a vative a mavonela ya vahanha va mughanga mayelano ni mavabji lawa angawona makarhataku ngopfu, nakona atativi lswi ava hanhi va nhimissa a swikarhatu swa utomi lavona. Ii xifananisso, a makungu manwana manga tsundzuxa a matsamela tiva a matirhisela ya ntumbuluku mayelano niku tivhikela sinwe djahene ka mavabji.

A mihandjo ya djondzo leyi yinga lhenglea aku pumbene kaku kwatlelisana aka vadhokodela kumbe va enfermeiro sinwe ni timbhabji. Hikuva aka xitsungu kuni mayendlela manwana yaku tlambuxela a mavabji, kambe vadhokodela ava switive.

Ntsengo unhigi wamavabji ya ntolovelu aka vatsongwana, kufana ni kuvuyelela, a dzedzedze sinwe ni mavabji yaku hefemula manga vhikeliwa a kaya, hicolanu i swalisima kuva a djondzo leyi yi endliwa hiku xiya-xiya lomu uni mintine.

Va xinuna (vaxisati) va hlawuliwile aku kumuka ka djondzo hikhambe leli, hinga laku dhokadhokisawa hi mintlawa inayelano nita utomi la vatsongwana nita mahanhele aka xitsungu lexi.

A ntlangu lowo uta heta nkama kumbe ni nampfu. Munhu ni munhu a tsuxiwile akuva ata lhaya leswe aswilavaka mayelano ni nhaka leyi hingata yi landza. Ku fambene ka ntlanganu hita tsala leswingatava swi lhayiwile niloko mipfumela hita swikola hikola ka xikhomamoya aka mabulo lawa.

Aku kumeka ka dionzo leyi a hixikhomela, hileswaku akuna munhu lweyi a sinzisikwaka kuva akumeka kona.

Hambi lava vangata tihlaya kuva vakukuka ka djondzo leyi vanga switsika kama wihi na wihi liko va swilava.

Akungatava ni swikarhato hikola ka leswo (avangata hakela nandzu na unwe nakona avangata khatisiwa).

Amahungo hinkwalo lawa hingatamukuma matavekiwa xi hundleni, nakunga tiviwe lweyi ama lhayeke, hileswaku a vito lawena alingata kumeka a ntsungwine hambe ka phepha linwana ni linwana. A matsalwa lawa hingata makuma swinwe ni mavito, swita tirhisiwa nstna aku lulami seneka djonzo.

Ungava ni xitiviso lexi unga navela ku xi endla mayelano leswi higa heta ku kuilamuxela?

Wa pfumela ku kumeka ka djondzo?

LONDON SCHOOL OF HYGIENE & TROPICAL MEDICINE

TSINZA YA USETCHI HI UTOMI YA KA MANHIÇA

Djonzo ya Leswi Honetelaka a Swihena Leswi Fambelanaka ni Utomi bya Vanu eka Mbangu wa pela djambu ra Moçambique

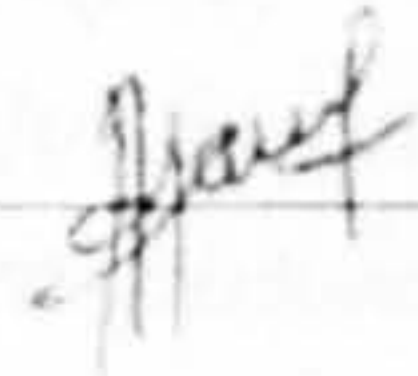
Ku xiya / Swivutiso eka swiru swa mindangu

Ku boha ka xipfumelano

Mina Juliete Francisco Marcello, ni wu twisisile a ntiru lowu, na pfumela a ni pfumeli a kuva munti wanga ukumeka ka djondzo leyi. Na switiva swa ku ni ta hambwa swivutiso hi ilelo ra mahanhele Belarmino Zedeiras Ndiande (vito ra tsonguana) na kona ku ta langutisiwa a mahanhele ya mindjangu.

Kusama kumbe lintilu
Manhiça 14 / 10 / 2003

Kusama ka musetehi
Manhiça 14 / 14 / 2003





LONDON SCHOOL OF HYGIENE & TROPICAL MEDICINE
CENTRO DE INVESTIGAÇÃO EM SAÚDE DA MANHIÇA
Republic of Mozambique



Serial Number

HOUSEHOLD ENVIRONMENTAL HEALTH STUDY - 2003
Socio-economic and demographic questionnaire

- *Please confirm that the listed child (or children) lives in this household. IF not, write down below the reasons, thank the person for the attention and leave the house. If yes, precede with the selection of the index child, in case there is more than one child under -5 residing in the household.*

- *Ask to see the index child's main caretaker. If absent, find out when the person is likely to be available within the next few days and arrange for a visit then. If never available ask for the person that stays with the child on the absence of the above identified caretaker.*
- *Read carefully and clearly the contents of the information sheet and informed consent of the candidate respondent*

1 **Did the respondent accept to participate in the study**
[1] = Yes
[2] = No → 2, 3, 0, 5 and terminate the questionnaire

2 If not, what were the reasons given by the respondent? _____

3 Date of the questionnaire (dd/mm/yyyy) / /

A – HOUSEHOLD INFORMATION

4 Bairro

5 HH number -

Appendix 6: Translated socio-economic and demographic questionnaire

- 6 How many people live to this HH? □□
- 7 How many children that have not completed 5 years of age live in this HH? □□
- 8 What is the main language spoken in this HH? □
 [1] = Changana
 [2] = Ronga
 [3] = Portuguese
 [4] = Other _____
- 9 Is any other language spoken? □
 [1] = Yes (which?) _____
 [2] = No

B – HEAD OF HOUSEHOLD INFORMATION

- 10 What is the name of the HoH?
 □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
- 11 Sex of the HoH □
 [1] = Male
 [2] = Female
- 12 What is the relationship between the HoH and the index child? □
 [1] = Mother → 19
 [2] = Father
 [3] = Stepfather
 [4] = Grandmother _____
 [5] = Grandfather _____
 [6] = Other _____
- 13 Has the HoH ever gone to school? □
 [1] = Yes
 [2] = No → 15
- 14 If yes, until which grade (completed grade)? □□
- 15 If not, is HoH able to read (ex.: able to read the Bible)? □
 [1] = Yes
 [2] = No
- 16 What is the occupation of the HoH? □□

- 17 Does HoH have an income? □□
 [1] = Yes
 [2] = No → 19
 [88] = Unknown → 19

- 18 If yes, what is the income regularity?
[1] = Regular _____ (MZM, specify if per day, week or month)
[2] = Irregular
[88] = Unknown

C – INDEX CHILD'S DETAILS

- 19 What is the name of the index child?
- 20 Index child's PERM_ID (copy from the card) - -
- 21 Sex of the index child
[1] = Male
[2] = Female
- 22 When was the child born? (check from the card) / /
- 23 Of development is the index child? _____

Use the table used by CISM to determine the child's age

D – MOTHER/CARETAKER'S DETAILS

- 24 Is the caretaker the index child's mother?
[1] = Yes → 27
[2] = No
- 25 If not, what is the caretaker in relation to the index child? _____
- 26 To the interviewer: Note the reasons why the mother is not the caretaker: _____

- 27 How old is the caretaker?
- 28 Has the caretaker ever gone to school?
[1] = Yes
[2] = No → 30
- 29 If yes, until which grade (completed grade)?

Appendix 6: Translated socio-economic and demographic questionnaire

- 30 Has the caretaker ever received adult literacy classes?
 [1] = Yes
 [2] = No → 32
- 31 If yes, how many years has caretaker been enrolled in the classes?
 [1] = Less than 1 [4] = 3 or more
 [2] = 1 [88] = Unknown
 [3] = 2
- 32 If not, is caretaker able to read (**ex.: able to read the Bible**)?
 [1] = Yes
 [2] = No
- 33 What is the occupation of the caretaker?
 [1] = Farmer

 [2] = Informal trader _____
 [4] = Unemployed
 [5] = Other _____
- 34 Does caretaker have an income?
 [1] = Yes
 [2] = No → 37
- 35 If yes, what is the income regularity?
 [1] = Regular _____ (MZM, specify if per day, week or month)
 [2] = Irregular
 [88] = Unknown
- 36 Is caretaker involved in a *xitique* group?
 [1] = Yes
 [2] = No
- 37 What is the marital status of the caretaker
 [1] = No partner (specify, e.g., widow, separated) _____ → 40
 [2] = Has partner, not living in the same household
 [3] = Married/has partner but partner is absent
 [4] = Married/lives with partner
 [5] = Other _____ → 40
- 38 Caretaker's partner's relationship with the index child
 [1] = Father
 [2] = Stepfather
 [3] = Other _____
- 39 Caretaker's partner's relationship with the HoH
 [1] = HoH [4] = HoH's brother
 [2] = HoH's son [5] = Other _____
 [3] = HoH's grandson

F – HOUSEHOLD ENVIRONMENTAL HEALTH

- 40 What are your sources of drinking water? (X)
- River
 - Protected well
 - Unprotected well
 - Pump
 - Tap
 - Other _____

- 41 Where is the main source of drinking water (the one you use more often) located?
- [1] = Within the confinements of the yard
 - [2] = In a different house
 - [3] = In a public area

- 42 Do you have a latrine within the confinements of the yard?
- [1] = Yes
 - [2] = No

- 43 What was used last night in order to deter mosquitoes where the index child slept? (X)
- Bednet (untreated) _____
 - Insecticide treated net
 - Sule (specify materials) _____
 - Mosquito coil
 - Aerosol spray (e.g., Baygon)
 - Other _____

- 44 What about in the last rainy season, were the same mosquito deterrence methods used in the index child's room or different ones?
- [1] = Same method → 47
 - [2] = Different method

- 45 If the method differed, what was done in the rainy season?
- Bednet (untreated) _____
 - Insecticide treated net
 - Sule (specify materials) _____
 - Mosquito coil
 - Aerosol spray (e.g., Baygon)
 - Other _____

- 46 What was the reason for this difference?
- _____
- _____
- _____

- 47 What about in the other bedrooms, was anything done to deter mosquitoes last night?
What? (X)
- Bednet (untreated) _____
- Insecticide treated net -----
- Sule (specify materials) _____
- Mosquito coil -----
- Aerosol spray (e.g., Baygon) -----
- Other _____
- 48 Which fuels do you use for cooking? (X)
- Reeds -----
- Crop residues -----
- Firewood -----
- Charcoal-----
- Kerosene -----
- Gas -----
- Electric energy -----
- Other _____
- 49 Where do you usually cook?
- [1] =Separate kitchen
- [2] =Indoors (not index child's bedroom)
- [3] =Indoors (other rooms) _____
- [4] = Open air
- [5] = Other _____
- 50 Where do you cook when it is raining?
- [1] =Separate kitchen
- [2] =Indoors (not index child's bedroom)
- [3] =Indoors (other rooms) _____
- [4] = Open air
- [5] = Other _____
- 51 Do you have soap today?
- [1] = Yes
- [2] = No → 54
- 52 What type of soap? (X)
- Soap Bar-----
- Powder soap (e.g. OMO) _____
- Cosmetic soap (e.g. Lux) -----
- Liquid soap _____
- Other _____

- 53 What do you use soap for? (X)
- Bathing-----
- Laundry-----
- Dishwashing-----
- Hand-washing-----
- Other-----

G – FURTHER LIVING STANDARD INDICATORS

- 54 Do you have the following items in this house?
 [1] = Yes
 [2] = No

- Functioning radio-----
- Functioning TV-----
- Functioning iron-----
- Functioning motorised vehicle (SPECIFY)-----
- Functioning Bicycle?-----
- Agricultural land other than the backyard-----

- 55 Do you have any livestock?
 [1] = Yes
 [2] = No

- 56 Specify type and number of animals below:

- Chickens-----
- Ducks-----
- Goats-----
- Pigs-----
- Cattle-----
- Other (SPECIFY)-----

- 57 What is the use of those animals?

(X)

- For our own consumption-----
- Own consumption and regular trading-----
- Own consumption and occasional trading-----
- Agricultural needs (e.g., animal traction)-----
- Transportation-----
- Other-----

Interviewer's name

Code

Signature _____



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 Republic of Mozambique



Número de série

HOUSEHOLD ENVIRONMENTAL HEALTH STUDY - 2003
Questionnaire on women's autonomy

Please administer these questions to the same respondent of the socio-economic and demographic questionnaire (index child's mother or caretaker). If in future visits to this house, the caretaker is different from the one responding to this questionnaire, you will have to administer another autonomy/decision-making questionnaire to her.

1 Questionnaire date (dd/mm/yyyy) / /

2 Questionnaire identification number

A – HOUSEHOLD

1. Neighbourhood

2. Household Number

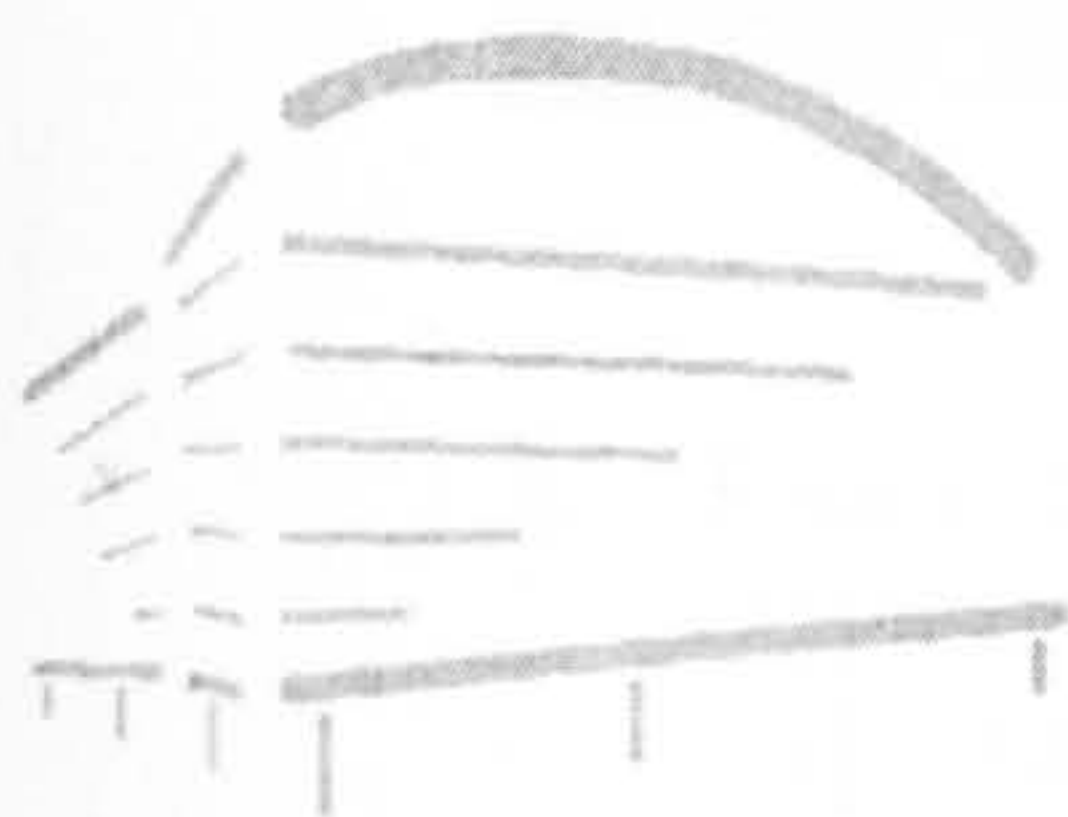
3. Head of household

4. Name of index child

5. PERM_ID of selected child

B – QUESTIONS ON CARETAKER'S AUTONOMY

6. When the child is sick who makes the final decision on what treatment to follow about the treatment (who decides whether to go to the hospital, stay at home or to go to the traditional healer)?-----||
- | | |
|---------------------------|---|
| [1] = Caretaker | [5] = Caretaker's in-laws |
| [2] = Caretaker's partner | [6] = Caretaker and others (equal responsibilities) |
| [3] = Caretaker's mother | [7] = Other _____ |
| [4] = Caretaker's father | |
7. When you are sick who decides about the treatment ? -----||
- | | |
|---------------------------|---|
| [1] = Caretaker | [5] = Caretaker's in-laws |
| [2] = Caretaker's partner | [6] = Caretaker and others (equal responsibilities) |
| [3] = Caretaker's mother | [7] = Other _____ |
| [4] = Caretaker's father | |
8. Who decides where and what to buy for the daily meals? -----||
- | | |
|---------------------------|---|
| [1] = Caretaker | [5] = Caretaker's in-laws |
| [2] = Caretaker's partner | [6] = Caretaker and others (equal responsibilities) |
| [3] = Caretaker's mother | [7] = Other _____ |
| [4] = Caretaker's father | |
9. Who decides when and where to buy your own things (e.g., *capulanas*)? -----||
- | | |
|---------------------------|---|
| [1] = Caretaker | [5] = Caretaker's in-laws |
| [2] = Caretaker's partner | [6] = Caretaker and others (equal responsibilities) |
| [3] = Caretaker's mother | [7] = Other _____ |
| [4] = Caretaker's father | |
10. Where to your direct relatives (maternal) live in relation to you?-----||
- | | |
|--------------------------|-------------------------------------|
| [1] = Same house | [4] = Other neighbourhood (Manhiça) |
| [2] = Next door | [5] = Outside Manhiça/deceased |
| [3] = Same neighbourhood | |
11. How do you manage money for your needs/household needs? -----||
- | |
|---|
| [1] = I earn my own money and I manage it myself |
| [2] = My husband gives me money, and I decide what to do with it |
| [3] = Other relatives give me money and I decide what to do with it |
| [4] = I'm given money for specific reasons, and need to ask for it every time I need it |
| [3] = I don't handle money |
| [4] = Other _____ |



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Serial Number

HOUSEHOLD ENVIRONMENTAL HEALTH STUDY - 2003

Spot-check observation

Once finished with the questionnaire, look around you, ask permission to walk around the house and answer the following questions according what you have observed.

A – HOUSEHOLD INFORMATION

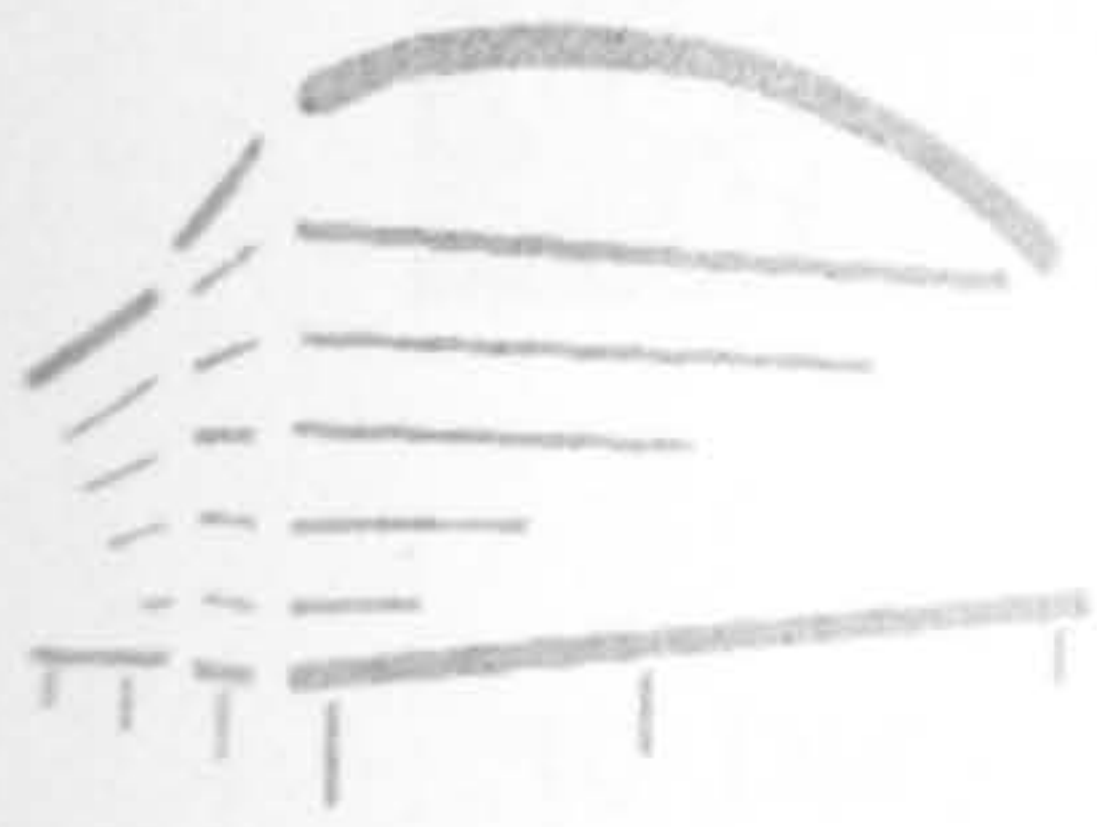
- 1 Observation date (dd/mm/yyyy) / /
- 2 Questionnaire identification number
- 3 Neighbourhood
- 4 Household number -
- 5 HoH name
- 6 Index child name
- 7 Index child's PERM_ID --

B- HOUSES PHYSICAL CHARACTERISTICS

- 8 Floor material of main building □□
 [1] = Earth
 [2] = Cement
 [3] = Other _____
 [88] = N/O
- 9 Wall material of main building □
 [1] = Bare reeds
 [2] = Daubed reeds _____
 [3] = Bricks/cement
 [4] = Other _____
- 10 Roof in main building □□
 [1] = Thatched
 [2] = Zinc
 [3] = other _____
 [88] = N/O

C- DOMESTIC HYGIENE

- 11 Did you observe any faeces on the yard floor? □
 [1] = Yes, human's
 [2] = Yes, animal's
 [3] = Yes, unable to distinguish
 [4] = No
- 12 Did the yard have signs of having been swept? □
 [1] = Yes, no debris
 [2] = Some debris
 [3] = A lot of debris
- 13 Did you see domestic animals around? □
 [1] = Yes, all penned
 [2] = Yes, some penned, others free-range
 [3] = Yes, all free-range
 [88] = No animals seen
- 14 Where were the kitchen utensils seen, if any? □
 [1] = Floor
 [2] = Dish-rack
 [3] = Other (off floor) _____
 [88] = No kitchen utensils observed



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HOUSEHOLD ENVIRONMENTAL HEALTH STUDY - 2003
Structured observation

A – HOUSEHOLD INFORMATION

- 1 Observation date (dd/mm/yyyy) / /
- 2 Questionnaire identification number
- 3 Neighbourhood
- 4 Household number -
- 5 HoH name
- 6 Index child name

B- HOUSE CHARACTERISTICS

- 7 Floor material of main building
[1] = Earth
[2] = Cement
[3] = Other _____
[88] = N/O
- 8 Wall material of main building
[1] = Bare reeds
[2] = Daubed reeds _____
[3] = Bricks/cement
[4] = Other _____
- 9 Roof in main building
[1] = Thatched
[2] = Zinc
[3] = other _____
[88] = N/O

C- INDEX CHILD'S BEDROOM

10 Did you have the opportunity to observe the index child's room?
[1] = Yes ▶ 12
[2] = No

11 If not, why?

12 If yes, what were the walls made of?
[1] = Bare reeds [3] = Bricks/cement
[2] = Daubed reeds _____ [4] = Other: _____

13 When in the room with the doors and windows closed, did you see gaps between the roof and the walls (big enough for sunlight to shine through)?
[1] = Yes
[2] = No

14 When in the room with the doors and windows closed, did you see gaps in any wall (big enough for sunlight to shine through)?
[1] = Yes
[2] = No

15 Did you see any bednet hanging over index child's bed/ sleeping rug?
[1] = Yes
[2] = No

16 Did you see any remains of mosquito deterrence products, possibly used on previous night?
[1] = Yes
[2] = No

C- YARD

17 Did the yard have signs of having been swept?
[1] = Yes, no debris
[2] = Some debris
[3] = A lot of debris

18 Did you see domestic animals around?
 [1] = Yes, all penned
 [2] = Yes, some penned, others free-range
 [3] = Yes, all free-range
 [88] = No animals seen

19 Where were the kitchen utensils seen, if any?
 [1] = Floor [3] = Other (off floor) _____
 [2] = Dish-rack [88] = No kitchen utensils observed

D- SANITATION CONDITIONS

20 Did you have the opportunity to visit the toilet/latrine?
 [1] = Yes
 [2] = No

21 If not what was the reason?
 [1] = The house has no toilet/latrine
 [2] = The existent toilet is out of order
 [3] = Not allowed
 [4] = Other _____

22 If yes, what type of slab did it have?
 [1] = Cement (sanplat) [4] = Other materials: _____
 [2] = Other type of cement slab [5] = No slab/seat
 [3] = Ceramic bowl (m'benga) [6] = other _____

23 Was there a lid to cover the squatting hole?
 [1] = Yes, misplaced
 [2] = Yes, in place
 [3] = No

E- STOOL DISPOSAL AND HAND-WASHING

24 Did you observe any child between 0 and 5 years old defecating in the open?
 [1] = Yes, the index child
 [2] = Yes, another child aged ____ years/months (DELETE AS APPROPRIATE)
 [3] = Not > 35

25 If yes, where?
 [1] = Nappies/panties [4] = Potty
 [2] = Yard floor [6] = Other _____
 [3] = Outside the yard

26 Who cleansed the child's bottom afterwards? □□
 [1] = Nobody ▶ 32 [4] = Mother
 [2] = Self [5] = Other _____
 [3] = Brother/sister (DELETE) [88] = N/O ▶ 32

27 If the child's bottom was cleansed, which material was used? □□
 [1] = Leaves [5] = Nappies
 [2] = Water [6] = Other _____
 [3] = Water + soap [88] = N/O ▶ 29
 [4] = Toilet paper

28 Where was the cleansing material disposed of? □□
 [1] = Outside the yard [5] = Latrine/toilet
 [2] = Yard floor [6] = Other _____
 [3] = Rubbish pit/heap in the yard [88] = N/O
 [4] = Buried in the yard

29 If the child defecated in nappies/pants/clothing, where did these end up? □□
 [1] = Remained on child [5] = Soaked in water
 [2] = Floor [5] = Washed
 [3] = Laundry heap/empty basin [6] = Other _____
 [4] = Empty washbasin [88] = N/O

30 If the clothing was washed, where did the used water end up? □□
 [1] = Yard floor [6] = Other _____
 [3] = Outside the yard [88] = N/O
 [2] = Remained in washbasin

31 Did the cleanser wash his/her hands after cleaning the child's bottom and/or handling soiled materials? □□
 [1] = No
 [2] = Yes (both hands with water + soap)
 [3] = Yes, different mode _____
 [88] = N/O

32 Where did the faeces end up during the course of the visit? □□
 [1] = Wrapped with nappies/cloth [6] = Rubbish pit/heap
 [2] = Floor (not removed) ▶ 35 [7] = Buried
 [3] = Swept/taken into a corner [8] = Latrine
 [4] = Washed with the soiled clothes ▶ 30 [9] = Other _____
 [5] = Taken out of the yard [88] = N/O

33 Who handled the faeces? □
 [1] = Nobody ▶ 35 [4] = mother
 [2] = Self [5] = other _____
 [3] = Brother/sister _____ [88] = N/O

34 Did the person who handled the faeces wash his/her hands?
 [1] = No ▶ 35
 [2] = Yes (both hands with water+ soap)
 [[3] = Yes, different mode _____
 [88] = N/O ▶ 35

35 Did you observe any child going to the toilet/latrine?
 [1] = Yes, the child index
 [2] = Yes, another child aged ____ years/months (DELETE AS APPROPRIATE)
 [3] = No ▶ 39

36 If yes, time taken inside the toilet, in minutes (USE STOPWATCH) _____

37 What happened when he/she came out of the toilet/latrine?
 [1] = Somebody washed his/her hands
 [2] = Washed hands him/herself
 [3] = Did not wash hands ▶ 39
 [88] = N/O ▶ 39

38 Hand-washing mode
 [1] = Both hands with water and soap
 [2] = Different mode _____

39 Did you observe any adult going to the toilet?
 [1] = Yes
 [2] = No ▶ 41

40 After using the toilet did he/she wash his/her hands?
 [1] = No
 [2] = Yes (both hands with soap + water)
 [2] = Yes, different mode _____
 [88] = N/O

C- WATER STORAGE

41 Did you see stored water?
 [1] = Yes
 [2] = No

42 Where was the stored water?
 [1] = Indoors
 [2] = Outdoors

43 Was the receptacle covered (lid in place)?
 [1] = Yes
 [2] = No
 [3] = Varied (some covered others not)



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Serial number

HOUSEHOLD ENVIRONMENTAL HEALTH STUDY
Semi-structured interviews

A –

- 1 Interview date (dd/ mm/ yyyy) / /
- 2 Neighbourhood
- 3 Household Number -
- 4 Housing type (what are the walls of the main building made of?) _____
- 5 Head of household
- 6 Head of household sex _____
- 7 Number of householders
- 8 Number of children under 5 years
- 9 Name of index child
- 10 Name of interviewee
- 11 Relationship with the index child _____
- 12 Age (years)
- 13 Marital status _____

14 Interviewees education level (years) |_|_|

15 Interviewees occupation _____

16 Respondent's income (regular, irregular, none) _____

17 Ethnic group (e.g., Changana, Ronga, etc.) _____

A -

1. Do you have a bednet?

2. Tell me how you have obtained it (who brought it home, how was it acquired, where from)?

3. If it was purchased, where was it purchased from and how much did it cost?

4. Whose initiative was it to acquire the bednet (or bednets) and why is it that it was decided that a bednet should be obtained?

5. Who sleeps under the bednet(s)?

12. If you were to acquire a bednet, who would be involved in the decision-making process and the actual purchase?

13. If you only had one bednet, who would sleep under it (why)?

14. Do you know any family that has bednets?

15. What do you think of those families that have bednets (do they differ from those without bednets/ in what way)?

16. Do you use any other form of deterring mosquitoes at night (what methods)?

17. Tell me how you obtain them (who brings them home, how they are acquired, where from)?

18. If it is purchased, where is it purchased from and how much does it cost?

19. Who has decided that that method should be used?

20. What is the effect of such method (s) (in what way do they help, does it make a difference between using them and not using them)?

21. Do you think it serves its purpose well or not (why/why not)?

22. If you were to choose another method, which would you have preferred (why)?

23. Do you have soap today?

24. On what occasions do you feel the need to wash your hands?
25. Do you think it makes any difference between using soap for hand-washing and using water only? (What difference?)
26. I've seen some women using lemon leaves for their hands. What is it for, when is it necessary to use leaves? What else serves the same purpose?
27. Do you have a latrine (describe your latrine – e.g., what materials were used to construct it)?
28. Does the index child ever use the latrine?
29. At what age do you think children should start using latrines? (Why not earlier than that?)
30. What can be done in order for them to start using latrines earlier?

31. What do you think of children's stools on the ground? (is it normal, acceptable, why?)

32. Is it the same as seeing adults' stools on the ground? (why)

33. What do you think of those families that do not have latrines (do they differ from those with latrines/ why don't they have latrines)?

34. Have you ever heard of improved latrines?

35. Do you see any difference between that type of latrine and the ones built with local materials? (what differences)

36. Do you know any family with one?

37. What do you think of those families that have improved latrines (do they differ from those without them/ in what way)?

38. Have you ever thought about getting an improved latrine?

39. What stops you from having one?

40. Who would be involved in the process of acquiring one (initiative, financial contribution, purchaser of materials, builder)?

41. How do children catch malaria?

42. How do children catch diarrhoea?



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FGD Number

HOUSEHOLD ENVIRONMENTAL HEALTH STUDY
Focus group discussions: Three pile sorting

A –

- 1 FGD date (dd/ mm/ yyyy)
- 2 Neighbourhood
- 3 Number of participants at the start of the exercise
- 4 Number of participants at the end of the exercise
- 5 Participants: MEN/ YOUNGER WOMEN/ OLDER WOMEN (**CIRCLE**)

B – PROCEDURE AND NOTES

1. The facilitator distributes the illustrations amongst the participants
2. The facilitator asks the participants to think about the illustrations, discuss amongst themselves what they think of them (share the illustrations, exchange them, etc)
3. The facilitator asks the participants to organise the illustrations into three piles at the centre: one comprising “good, acceptable practices”, one comprising “bad, unacceptable practices”, one for “intermediate”.

4. The facilitator picks up the illustrations from the “good pile”, one in turn, and throws 2 open questions to the plenary: What is this picture about? Why is it that this practice is “good”?

ANNOTATIONS TO THE NOTE TAKER:

In the following pages, write down the tag number of each good practice and take notes on what the participants say about them.

5. The facilitator picks up the illustrations from the “bad pile”, one in turn, and throws 2 open questions to the plenary: What is this picture about? Why is it that this practice is “bad”?

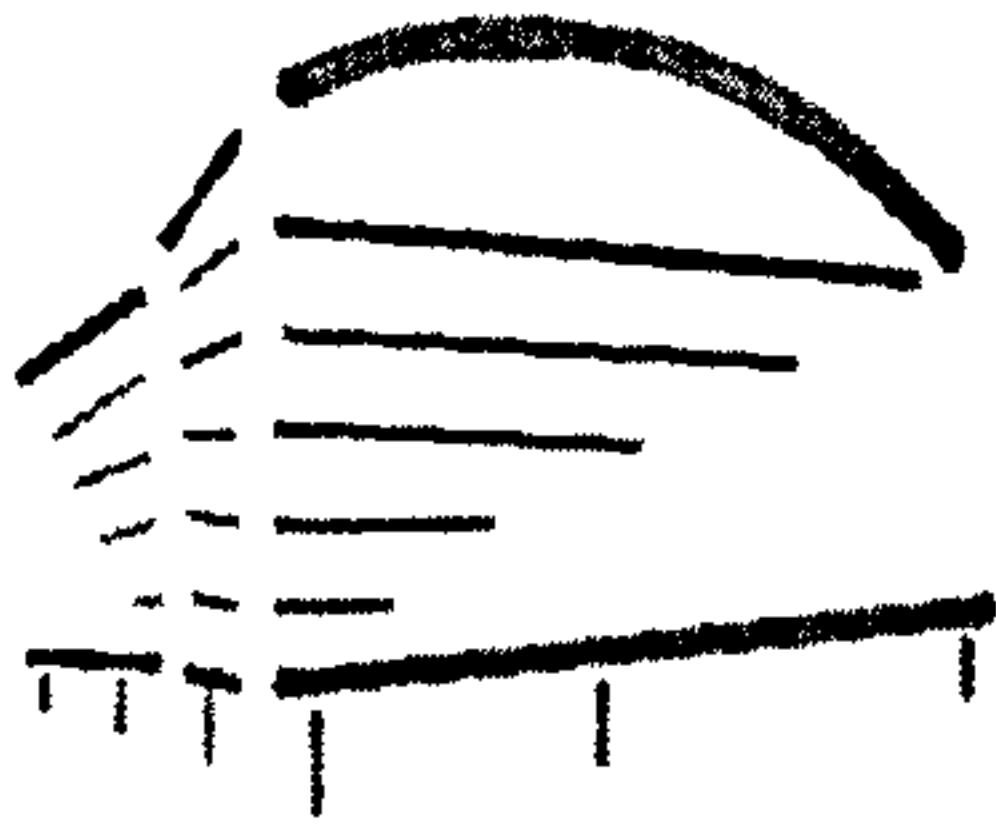
ANNOTATIONS TO THE NOTE TAKER:

In the following pages, write down the tag number of each bad practice and take notes on what the participants say about them

6. The facilitator picks up the illustrations from the “bad pile”, one in turn, and throws 2 open questions to the plenary: What is this picture about? Why is it that this practice is “bad”?

ANNOTATIONS TO THE NOTE TAKER:

In the following pages, write down the tag number of each bad practice and take notes on what the participants say about them



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FGD Number

HOUSEHOLD ENVIRONMENTAL HEALTH STUDY
Focus group discussions: Nurse Felicidade



- 1 Interview date (dd/mm/yyyy) / /
- 2 Neighbourhood
- 3 Number of participants at the start of the exercise
- 4 Number of participants at the end of the exercise
- 5 Participants: MEN/ YOUNGER WOMEN/ OLDER WOMEN (CIRCLE)



1. The facilitator starts the discussion by introducing Nurse Felicidade to the group. E.g., "This is Nurse Felicidade". Then puts the illustration at the centre and explains that she is at the health post waiting for her patients to arrive.
2. The facilitator distributes the other illustrations amongst the participants, and explains that each illustration represents a person that might be ill and is queuing up at the health post to see Nurse Felicidade.
3. The facilitator asks the participants to think about the illustrations, and discuss amongst themselves why they think those people are at the health post.
4. The facilitator asks each participant that holds an illustration to put it at the centre, next to Nurse Felicidade. The plenary is asked to explain what type of disease the person might be suffering from, and describe the signs and symptoms.

5. Following the discussion on each illness, the facilitator asks if that particular illness affects children in Manhiça.

ANNOTATIONS TO THE NOTE TAKER:

In the following pages, write down a list of the names of the illnesses mentioned by the participants and the signs and symptoms. Mark the illnesses that, according to the participants, affect children under 5.

6. The facilitator asks the note-taker to read out the names of the illnesses that affect children, and asks to the participants whether each of the mentioned illness is preventable and how.

ANNOTATIONS TO THE NOTE TAKER:

In the following pages, write down the names of the illnesses mentioned by the participants and the preventive measures mentioned.